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THE FOUNDRY TRADE JOURNAL IS THE OFFICIAL ORGAN OF THE INSTITUTE OF BRITISH FOUNDRYMEN; THE WELSH ENGINEERS' AND FOUNDERS' ASSOCIATION, AND THE FOUNDRY TRADES' EQUIPMENT AND SUPPLIES ASSOCIATION.

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Forthcoming Events.

FEBRUARY 9.

Institute of Metals (Swansea Local Section):—Ordinary meeting. "Zinc—the Utility Metal," Paper by E. Evans, B.Sc.

FEBRUARY 10.

Institute of Metals (London Local Section):—Ordinary meeting. "Some Recent Advances in Protective Coatings on Metals," Paper by H. Sutton, M.Sc.

Institute of British Foundrymen.

FEBRUARY 6.

East Midlands Branch (Lincolnshire Section):—Ordinary meeting. "The Effect of the Elements on Cast Iron and its Properties," Paper by A. E. Musgrove.

Lancashire Branch:—Annual dinner at the Grand Hotel, Manchester.

FEBRUARY 9.

Sheffield Metallurgical Association:—Ordinary meeting. "Metal Spraying," Paper by Kenneth Gray.

FEBRUARY 11.

Institution of Welding Engineers:—Ordinary meeting in London. "Welding and Cutting on Railways and Tramways."

The Census Again.

We make no apologies for returning to the figures revealed by the 1930 Census of Production for the iron and steel founding industry.

The value of the gross output is given as 27½ millions sterling for 767 establishments. Bearing in mind that the total figure must be much larger than this and that in any case the Census did not record small establishments, the figure agrees well with Mr. J. G. Pearce's estimate of the value of the products of the industry of 40 millions sterling, treated as finished castings. The value of the net output is given as 16 millions sterling, so that the amount expended by the producers on their raw materials was the difference between 27½ and 16, or 11½ millions sterling. When the unregistered foundries are taken into account, and when the expenditure on equipment is taken into account as well as expenditure on materials, our own estimate of 26 millions as the buying capacity of the industry is also probably very near the mark.

We hope that these figures will be taken in future at more frequent intervals and the results made available more rapidly. We should not have to wait until 1932 for results of a Census taken for 1930. Figures of this kind enable a business man to tell whether an advance or a decline in his own business is due to local or general causes, whether his fluctuations are going with or against those of the trade as a whole. They enable him to plan ahead on a sound basis to meet the inevitable contractions and expansions of business.

The 767 establishments covered by the Census employed 85,000 people, and the output per head is thus £188. We shall have some comparisons to make later with similar figures for other industries. This figure is very low. If the average value of the labour of the operative is offset against this figure, it will be seen how little margin is left for all other charges.

The gross output included half-a-million tons of pipes and fittings, valued at 5¼ millions sterling; 166,000 tons of light castings, valued at 6½ millions sterling; a hundred thousand tons of railway material, valued at a figure approaching a million sterling; and a quarter of a million tons of engineering castings, valued at over five millions sterling. In the non-ferrous statistics, founding is not separated from rolling and other processes.

An Innovation.

The Institute of Metals, at the next annual general meeting, to be held in London on March 9 and 10, will embark on a new and commendable enterprise in the form of devoting the afternoon of the second day to general discussion on "The Testing of Castings." To our mind it is essential that the practical foundryman should take part in this discussion, as it is the easiest matter in the world for the man of academical training to fall into quite serious errors. For instance, during a discussion on the preparation of a specification for high-duty cast iron for one of the great Government departments, the representatives of theory wished to impose certain conditions which were impossible of being fulfilled, because weight alone necessitated a composition suitable for maintaining fluidity whilst a large quantity of metal could be collected. Thus the specification eventually had to take care of "life" of the liquid metal rather than its ultimate use.

A specially interesting feature of this discussion is the fact that it is to be opened by Dr. W. Rosenhain, F.R.S., who recently had the honour of presiding over a similar sort of meeting held at Zürich under the auspices of the New International Association for Testing Materials. He is, therefore, in a splendid position to crystallise international thought for the benefit of the members. Visitors are invited to take part in this discussion, and cards admitting to the meeting are obtainable on application to Mr. G. Shaw Scott, M.Sc., 36, Victoria Street, London, S.W.1. By the way, the Institute is offering rather special privileges to those who are sufficiently fortunate to be elected at a Council meeting scheduled to take place on February 18.

Customs of the Trade.

The various foundry employers' federations which have so kindly written to correct our observations on the insurance of customers' patterns have done a real service to their industry. In dealing with the subject originally, we stated:—"Founders should realise that in asking us to state what we believe to be the custom of the trade they are taking quite a serious step, for if our ruling remains unchallenged, by correspondence, for example, it can be quoted fairly effectively in any legal action." As a result of the public-spirited action of several of the employers' federations, it must now be enunciated quite definitely that it is *not* the custom of the trade for foundry concerns to cover by insurance any loss sustainable by any firm confiding their patterns to the care of any foundry for any purpose whatsoever.

XUM

Correspondence.

[We accept no responsibility for the statements made or the opinions expressed by our correspondents]

A Paper "Wangle."

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—I am very interested indeed in your leading article, "A Paper 'Wangle,'" appearing in your issue of January 28, and you have most certainly attacked a very weak point in foundry costing and one where the uninitiated are very liable to be led away through the wish being father to the thought. Of course, the only correct value put upon domestic scrap is the cost of the raw materials which have entered into making that scrap, and if one likes to go a step farther one can say that the actual value of the scrap has been increased by the loss in melting plus the cost of melting. As an example, in our own works here we only use virgin pig; we buy no scrap whatever. We cannot afford to do so and jeopardise the quality of our product. Therefore it is ridiculous for us to say that our domestic scrap is only of the same value as the current market price of scrap.

This point occupied our attention very largely immediately after the war, and I enclose you herewith reprint of an article which I wrote for the technical Press as far back as November, 1921.—Yours, etc.,

V. JOBSON.

Qualcast, Limited, Derby,
January 30, 1932.

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—Your article "A Paper 'Wangle'" is extremely interesting so far as it goes, but why stop at domestic scrap? I venture to say there is not a foundry in this country that can give a true "cost-of-metal-at-the-spout" figure, since, in my experience, none of them takes into account quite a number of items which total a not inconsiderable sum of money per annum and which come under the heading of melting costs.

Here is one illustration of the kind of "wangle" I am referring to: Cupola repair costs show (officially) one ton of ganister being used daily, but when one goes more deeply into the matter, it is usually found as many as 50 to 100 bricks are also used, of which there is no record. In this way a cupola is often lined two or three times a year, yet official records will show it as being lined once only.

Again, take the question of slag. Four or five loads will be carted away daily at a cost in some cases of 5s. per load and more; yet one finds no mention of this item. These "paper" wangles are a source of a great loss of business to my firm, since when the argument turns on the question of cost, the ton of cheap ganister is the only item brought forward as evidence in favour of old-fashioned methods.

Of course, there are other "paper" wangles, such as the very comic way of carrying on I have encountered in a large Lancashire foundry during the past week, but sufficient for the day is the evil thereof.—Yours, etc.,

TOM H. GRAY.
(Thomas E. Gray & Company, Limited.)
119, High Holborn, London, W.C.1.
January 30, 1932.

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—At first reading the leading article in your issue of January 28 might be said to raise an interesting point, but to the modern foundry cost accountant, or foundry manager, it must be abundantly clear that you have missed the essentials.

At the outset you state that "one of the most interesting phases of cupola costing is the price which should be debited for returned scrap"; but surely any scheme of cupola records which attempts to value return scrap in the manner which has been brought to your notice, can only be described as an abortion, and is not in any way worthy to be labelled as a cupola costing system?

From the reference to "the tendency to use larger runners and risers than are strictly necessary by reason of this scheme of self-deception," it is evident that you have in mind the daily floating scrap from the moulding and dressing shops when you write of "domestic scrap." It is without doubt faulty costing practice to write down this material to a fictitiously low figure below the purchase price of the mix, without making a corresponding debit to allow for the recovery of the violent depreciation in value. It is a commonplace of any reliable costing system that goods or materials destroyed or consumed in the course of manufacture must be accounted for.

The remedy is not to be found in an attempt to assess the value of domestic scrap, but rather in the application of proper cupola costing methods. A cupola costing system which is capable of general application is to be aimed at, and the first consideration must be to ascertain the cost of melting. The output of good castings should form the basis on which to express this cost, and it is only necessary to deal with the actual items which constitute the cost of bringing down the metal. Under this heading it would be necessary to charge all the usual overheads, rent and rates, depreciation, etc., plus maintenance charges, power, coke, limestone, stores, labour, etc. The resultant figure, expressed as a rate per ton of the good castings produced, may be relied upon to be accurate, provided the records are carefully kept and the charges properly debited.

To arrive at the cost of the metal itself a very simple method would be to take the average price of the pig-iron and the outside scrap purchased for the corresponding period. The system of pricing the metal may, however, be adjusted to suit individual requirements and market fluctuations so long as the average market or purchase price of the pig-iron and outside scrap is aimed at.

Having determined the cost of melting and the price of the metal, the next step is to ascertain the loss of metal in melting. This is simply a question of comparing the consumption of purchased metals with the output of good castings, the difference representing the melting loss.

For estimating purposes all the necessary information is now available, viz.:—(1) Melting cost, (2) price of metal and (3) melting loss.

It is thus possible by the application of proper costing to ignore domestic scrap entirely. While this point cannot be too strongly emphasised, it is realised that for purely cupola-melting records it is well to keep daily track of all charges of metal, including domestic scrap, but the utility of these records is confined principally to comparative purposes.

In short, the fundamental of reliable cupola costing is to work on the basis of good castings produced and not on the tonnage of metal at the spout, and with the foundry accountant and the foundry manager working hand in glove (to achieve efficiency and accuracy), the state of Paper "Wangle" should not arise.

DUNDYDAN.

An American Appreciation.

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—For a number of years our company has subscribed to the FOUNDRY TRADE JOURNAL. The Metallurgical Department, especially, finds the articles pertaining to the metallurgy of cast iron most useful and instructive, and there is really no magazine that is received in this office which is held in any higher regard.

The British metallurgists and foundrymen are to be congratulated upon the very thorough and painstaking nature of their research in the field of cast-iron metallurgy. The FOUNDRY TRADE JOURNAL is to be complimented upon the splendid presentation of the various subjects, together with the discussions by various metallurgists, which add so materially to the value of these articles.

Many times the writer has intended to express this feeling that is so common in our organisation for your JOURNAL, and as your most interesting issue of December 31 was reviewed, it seemed that there was no time quite like the present to so inform you.—Yours, etc.,

R. F. HARRINGTON,
Metallurgist.

Hunt-Spiller Manfg. Corporation,
Boston.
January 15, 1932.

[It is in the ordinary way against our principles to publish letters of a laudatory character, and an exception is being made in this case because we interpret this message to be an appreciation of British research endeavour in the field of cast iron which our columns merely reflect. We would like to take this opportunity of thanking those readers who sent us congratulatory letters on the production of our Annual Review Number.—EDITOR.]

The High-Frequency Furnace.

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—The Paper read by Mr. T. R. Middleton before the Sheffield Section of the Institute of British Foundrymen and published in your current issue is the most important which has yet been given on that system of steel melting.

In the course of the Paper it is shown that the early objections raised against high-frequency melting were the product of expectation rather than experience. It is not unusual for deductions so made to be refuted later by facts, and probably the final "foreseen" trouble—not dealt with in the Paper—was that deleterious non-metallic inclusions would be found mixed with the steel as a result of the stirring of the metal which automatically takes place when the charge is melted. Personally, we were inclined to believe in such a possibility.

The opportunity arose of having some steel castings examined rigorously by the Royal Aircraft Establishment research laboratories. The castings were made in quite ordinary manner in a high-frequency furnace at these works, and sent for micrographic inspection. The R.A.E. officially reported that such inclusions were not present.

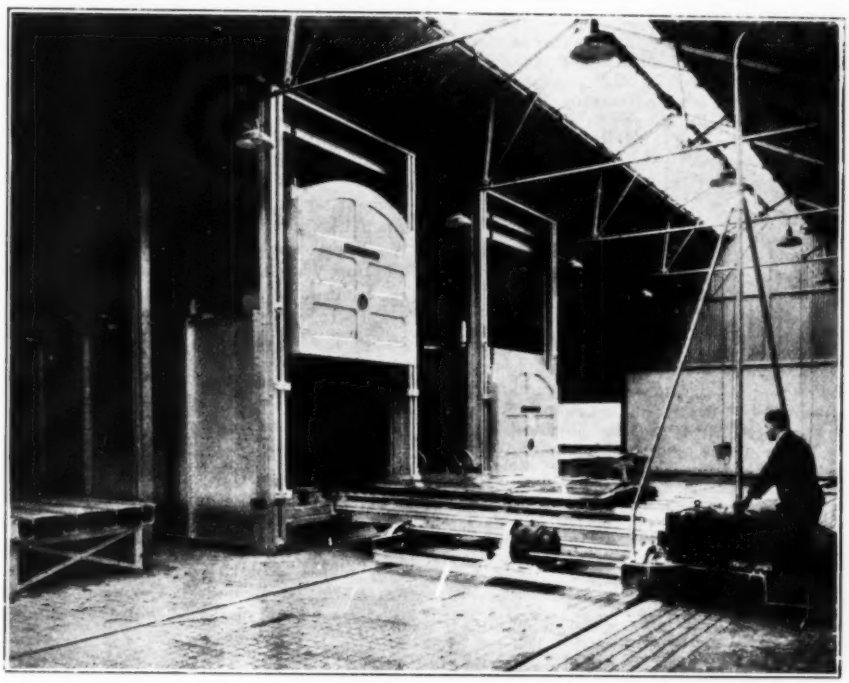
We experience with the Witton high-frequency furnace here lower electricity consumption per ton of steel than Mr. Middleton quotes. Whilst he mentions that figures "may be as low as 650 kw.-hrs. per ton," we seldom reach as high a consumption as that. Very complex steels—not including high-speed steel, which demands the least current of all steels, due probably to the low specific heat of tungsten—usually take 550 to 600 units per ton. A consumption below 500 units per ton has been obtained for plain carbon steel.

The question of current consumption merits serious investigation, for if it can be reduced 100 units per ton of steel, the economy with

(Concluded on next page.)

A Large Electric Furnace Installation.

The furnaces described below include two of the largest electric-resistance furnaces for heat-treatment so far installed in this country. There are three in all, two having a chamber size of 14 ft. long by 7 ft. wide by 5 ft. high to the spring of their arched roofs. The third one has a chamber 9 ft. 6 in. long by 4 ft. wide by 3 ft. to the spring of the arch. These furnaces are all fitted with Wild-Barfield patent centrifugal fans, which, beside assisting uniformity from end to end of the furnaces, greatly decrease the heating time required for a charge to attain its desired temperature. Two of these fans are situated in the roof of each furnace, and consist of a built-up box-type two-bladed fan of heat-resisting material. These are mounted on the vertical heat-resisting shafts of bevel reduction gear-boxes, which reduce from motor speed to 400 r.p.m. The gear-boxes are of special design to give long bearing centres which ensure a long life and reduced strain on the ball bearings, which are of ample dimensions. The gears are driven by a 2-h.p. double-spindle motor, which is situated between them and coupled thereto by means of universal joints, the whole being carried on a substantial steel structure on the top of the furnace.



AN ELECTRICALLY-HEATED HEAT-TREATMENT FURNACE, SHOWING THE GIBBONS-VAN MARLE CHARGING MACHINE.

The chambers of these furnaces are lined with Wild-Barfield tunnel bricks, which house thick rod elements in patent hairpin form, the ends of each hairpin being thickened to four times the element area where they pass through the insulation at the back of the furnace to avoid hot connections and loss of power. The side and roof elements are connected up at the back of the furnace to suit the mains voltage, which is 400, 3-phase, 50 cycles, the sides being on one phase, the roof on another, whilst the floor elements, to obviate risk of leakage of current through the charge, are connected to suit a lower voltage obtained by means of single-phase, oil-cooled, double-wound Ferranti transformers, wired to the third phase, making a total delta load of 200 kw. each in the large furnaces, and 100 kw. in the small one, all phases balanced.

Mechanical Charging Arrangements.

The floors of all furnaces are provided with longitudinal grooves to accommodate the arms of a Gibbons-Van Marle patent charging machine, which is hand-operated in the case of the small furnace, and electrically driven in the large ones. These machines enable a load to be placed in or removed from the furnace in less than two minutes, with a consequent saving in heat due to doors not being opened for a considerable time, as would be the case if work had to be pushed in by hand. Incidentally, with the machine it is possible to raise or lower the charge gently, reducing wear on the hearth to a minimum. This is accomplished by means of an inclined plane and roller device on the arms of the machine, which arms are also provided with rollers to ride in the furnace hearth grooves in order that the weight of the charge may be uniformly supported throughout its length, obviating undue strain on the machine carriage.

All furnaces are equipped with the Foster thermo-electric automatic controls, which operate the coils of the main Brookhirst contactors through a small relay, forming a means of accurate temperature control. The main current to the furnaces is automatically cut off, should the temperature accidentally rise to a value which is likely to cause damage to the charge, or the furnace elements, by means of a thermal fuse, which consists of a loop of fusible wire inserted in the furnace and held by a removable porcelain carrier forming a readily removable unit. This wire is connected in series with the main contactor coil, so that immediately the wire melts, the coil circuit is interrupted, which in turns causes the main current to be cut off. In this same coil circuit there is a Wild-Barfield patent double-pole door switch, having one pole connected each side of the fuse. This removes any risk of shock or short circuit should the elements or fuse be accidentally touched during charging or discharging. One of these switches is also used to interrupt the fan motor circuit whenever the door is opened, in order that heat may not be lost due to the heated air being blown out through the open door.

In the case of the smaller furnace, the complete control equipment and transformer are mounted on a platform fixed to the wall above the furnace, and in the case of the larger furnaces, the control equipment for both is mounted on uprights between the furnaces. It is interesting to note that each floor of the large furnaces weighs 2½ tons, the total weight of fireclay and other bricks used in the construction of these furnaces amounting to approximately 24 tons, and the weight of nickel chromium rod-heating elements weighing over ½ ton.

Correspondence.

(*Concluded from previous page.*)

electricity at 0.6d. per unit is 5s. per ton. With the output given in the Paper for a 5-cwt. furnace, this totals £5 per week, which is approximately sufficient to return an extra 5 per cent. per annum on the capital invested.

The carbon, chromium and manganese losses given by Mr. Middleton are valuable contributions. If he would supplement Table II by giving the chromium losses in consecutive heats of calculated equal content of chromium, it would be of yet additional interest.

May we, finally, congratulate Mr. Middleton on a really excellent Paper?—Yours, etc.,

P. WALTON.

(The Stobie Steel Company, Limited.)

Dunston-on-Tyne.

January 29, 1932.

Permanent Moulds for Rice Bowls.

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—Referring to page 402 of THE FOUNDRY TRADE JOURNAL for December 24, 1931, there is a short article on permanent moulds. A British firm in Singapore, who are regular subscribers to the JOURNAL, are desirous of using a set of 13 permanent moulds for the making of cast-iron rice or bale pots, which are flat, spherical-shaped cast-iron pots used in the East and varying in 13 sizes from 8 in. dia. and 2¾ in. deep to 20 in. dia. and 6 in. deep, the rim to be ⅛ in. thick and the rest of the body to be about 1/16 in. thick. I would be very much obliged if you could give me the names of firms who make these permanent moulds, when I could give them any further information required to enable them to quote for our requirements.—Yours, etc.,

CALEDONIAN.

Rationalisation in the Italian Steel Industry.—A consortium representing a section of the Italian steel industry was formed on a voluntary basis in August, 1929, but its purposes were to some extent defeated by the refusal of about 3 per cent. of the particular branch of the industry to join. An official decree has now been issued, the object of which is to compel recalcitrant manufacturers to join in these combines, which, in the words of the decree, are intended to bring order into the steel industry and arrive at a more rational organisation. The Minister for Corporations, to whom is entrusted the power of setting up such consortia, will, however, take no hand in their internal organisation and working. Statutes of each consortium are to be drawn up by a general assembly of its members. In the event of the assembly failing to secure the necessary quorum, or in the event of its members failing to agree, a binding decision will be taken by the President of the general Fascist confederation of industry. Once a consortium has been formed it will be illegal for any member to sell except in accordance with the rules of the consortium. The constitution of these consortia is at first to be temporary.

French Blast-Furnace Company to Organise Competition.

£100 FOR ESSAY ON CAST IRON.

The Centre de Recherches de Fonderie des Hauts Fourneaux de Saulnes is organising a competition which is open to our readers. We have translated the terms below, but disclaim any responsibility for the legality of our phrasing. As the typescript has to be in French, we shall be pleased to advise our readers as to the best method of accomplishing this.

Annual Competition to Develop the Use of Cast Iron.

Clause I.—An annual competition is being opened by the Société des Hauts Fourneaux de Saulnes (Jean Raty et Cie) to reward inventions capable of contributing to the development of the use of cast iron.

Clause II.—Each competitor must send an essay describing in a very complete manner the proposed invention and its practical interest, stressing the importance which would follow the application of his proposition from the point of view of the development of the use of cast iron. The essay should deal with a novelty, and must include, on the one hand, all the necessary instructions for allowing skilled persons to manufacture the novelty disclosed therein, and, on the other hand, an economic survey outlining the production costs and the expenditure.

Clause III.—The essays must be presented in French and typed; all the necessary designs and drawings to be attached thereto. They must contain no indication susceptible of directly disclosing the identity of the author, other than a *nom de plume* or mark, to be inscribed on a sealed envelope containing the name and address of the competitor. Entries must be sent in duplicate by registered post to the Centre de Recherches de Fonderie des Hauts Fourneaux de Saulnes, 18, Rue La Boétie, Paris VIII.

Clause IV.—For 1932, the opening of the competition is fixed for February 1. Entries may be sent any time after this, up to and including July 1. Any entry arriving after that date will be excluded. Competitors can, at their discretion, withdraw their essays or modify them up to July 1. Beyond this date they can only advise the organisers of the competition of their final wishes (*désistement*).

Clause V.—The entries will be judged without any right of appeal by a jury composed of the following:—*President*, Mr. Leon Guillet, member of the Institute, etc. *Members*, Mr. Marcel Ballay, D.Sc., etc.; Mr. Jean Cournot (lecturer at the Ecole Polytechnique, etc.); Mr. Joseph Dhavernas (President of Centre d'Information du Nickel); Mr. Jean Galibourg, D.Sc.; Mr. Emile Ramas, (Past-President of the French Foundry Technical Association, etc.); Mr. Georges Thevenin (general manager of the Saulnes Blast Furnace Company) and Mr. Auguste Le Thomas (director of the Centre de Recherches de Fonderie des Hauts Fourneaux de Saulnes).

Clause VI.—The jury will award a prize of 10,000 francs (momentarily worth about £113) to the best entry; this prize can be divided if the jury deems it desirable, taking into consideration the respective merit of the essays returned. The distribution of the prize can be reserved in whole or in part and carried over to augment the following competition if the jury deems that the essays submitted do not warrant any award. The essays not commended will not be returned.

Clause VII.—The jury will announce its decision in the course of the second half year of 1932. It will be announced primarily in "La Fonte," published by the Centre de Recherches de Fonderie des Haut Fourneaux de Saulnes. The jury reserves the right to publish the winning essays by arrangement with the authors.

Clause VIII.—Any patentable matter submitted in connection with the competition may be protected by the author in the French Patent Office for the period covered by the competition under the express condition that the jury is immediately advised of this action. In a case where a process has not been made the subject matter for a Patent application, the jury will take every possible precaution to suppress any publication (*divulgation*), but it is understood that it cannot assume any responsibility if publication (*divulgation*) is made, however.

Clause IX.—The mere fact of sending an essay according to the conditions set out in Clauses III and IV binds each competitor to a complete and unreserved acquiescence to the conditions of the present rules.

The Carron Staff Dinner.

The annual staff dinner of the Carron Company was held last month in the Dobbie Hall, Larbert. Mr. George Pate, O.B.E., J.P., manager of the company, presided over a company of about 180, and was supported by Mr. F. L. Burder, chairman of the company; Mr. C. M. Brown, secretary and voting partner; Dr. H. H. Brown and Mr. H. E. White, voting partners, and all the departmental managers.

The loyal toasts having been honoured, Mr. Pate dealt with the events of the past year so far as they affected Carron Company. The company had suffered badly from the trade depression, while in addition the national demand for economy had held up public utility schemes, which meant a further loss of work. He counselled his hearers in the difficult times which lay ahead to observe the old Scots saying, and put "a stout heart to a stey brae."

The toast of "The Carron Company" was proposed by Mr. J. R. Laird, the electrical engineer. In the course of his remarks, Mr. Laird traced the association of Carron Company with the various stages in the development of power, and how they were keeping abreast of present-day requirements in the classes of goods which they manufactured. Dr. Roebuck had, indeed, been a philosopher when, during one of the blackest periods in our history, he founded the company which still flourishes to-day.

Mr. Burder, in replying, referred to the visit of Prince George to the works, and reminded those present that this was not the first time the company had been honoured with Royal favour. In 1773 Carron Company became incorporated by Royal Charter, while in July, 1859, King Edward—then Prince of Wales—visited the works.

Catalogue Received.

Drying Stoves.—Messrs. Thomas E. Gray & Company, Limited, 119, High Holborn, London, W.C.1, have utilised a 4-page leaflet to describe the Herrmann System of mould and core drying. This particular problem is dual in character. Primarily, heat must be generated rapidly to neutralise heat losses which are consequent on time, and, secondly, the atmosphere in the stove must consist of dry hot air.

This pamphlet shows how these two factors are economically accomplished by the incorporation of a heat accumulator in the form of a mass of chequer masonry for heat retention and slow dissipation. The excellent temperature chart, which is reproduced on page 4, could be made much more valuable by indicating the period where firing stopped and where the temperature was maintained by the accumulator.

Sand-blasting Plant should be earthed electrically, otherwise there is some small danger of static electricity accumulating, due to the action of the sand on the metal.

Random Shots.

The foundry trade, you will agree, is not what it was. That, however, is no matter for folding of work-worn hands and an expression of fatalistic resignation. No, it's a matter for jubilation and feathers in your caps! (But don't expect *me* to recognise you if you come along to next Saturday's meeting with a peacock's plume stuck in your headgear.) The foundry trade that was is now an industry: officially, *soi-disant* and *nem. con.*, so to speak.

* * *

And now that we are an industry, what, precisely, are we going to do about it? (For we ought to something, you know, oughtn't we?) Set on more employees? Increase production? Urge for tariff reform? Write to the Press? Or what? I suggest none of these things.

* * *

There runs the old and wise saying about setting one's house in order, and although the foundry is a very uncomfortable house (what with drafts down the cupolas and other deplorable drawbacks), it is, nevertheless, a house of sorts—a form of work-house: at the present moment, it might be complained, rather too much like a work-house, but without the work. We might decide, in the first place, whether the building wherein ferrous metals are founded is an ironfoundry or an iron foundry. Believe me, there is nothing quite like standardisation, unless it's uniformity. Whoever has seen the expression "aluminiumfoundry"? If you ever have, depend upon it that the printer did not stick to his last (or his last was one too many for him).

* * *

Let me, therefore, move a resolution that "The expression 'ironfoundry' shall be abolished and hereafter replaced by the two distinct words, 'iron foundry.'" Would somebody please second that? What about you, Dr. Foster (of Gloucester)? The resolution applies, also, to "steelfoundry" and "brassfoundry."

* * *

A perusal of advance information on the British Industries Fair carries with it the expectation of a Bigger, Brighter Birmingham. There are, I gather, just over a thousand exhibitors in the heavy-industries section, which has been enlarged to about 13 acres in order to accommodate the tremendous influx of foreign buyers who (we hope) will attend the Fair. The present international financial muddle should create something in the nature of a "gold rush" on the part of those buyers whose native lands are still perched precariously on the standard. Birmingham, by the way, is going to be a city of arrows—green and (patriotically) red, white and blue. I hope they are not too broad!

Marksman.

Gutmann Sand-Blast Plant.—It is pleasing to announce that arrangements have been concluded between Messrs. Alfred Gutmann, of Hamburg, Messrs. T. Fearnley Allen & Son, of Norwich Union Chambers, Birmingham, and Messrs. Spencer & Halstead, Limited, of Ossett, near Leeds, whereby the last-named firm have been granted the licence to manufacture sand-blast plant to Messrs. Gutmann's well-known designs, whilst the sales organisation will be retained by Messrs. T. Fearnley Allen & Son. This new arrangement will ensure a continuity of service to existing users of Gutmann plant, whilst new customers will have the satisfaction of knowing that they will be buying British-made machinery.

Moulding and Casting a 32-Ton Foundation Block.

By G. E. Morgan.

(*Concluded from page 56.*)

Preparing the Pit.

The completion of the plates saw the biggest part of the tackle made and ready for use. Whilst they were being made, a gang of coolies had been busy digging a pit some 20 ft. square by 8 ft. deep, this giving a clearance of 3 and 4 ft. either side of the job for working purposes. Digging the pit was also no mean item of labour, as it called for the removal of some 3,200 cub. ft. of sand. The pit bottom was levelled off, and at equal distances apart four 16-ft. long by 8-in. by 6-in. cast-iron bars were set. These were to act as a base on which to

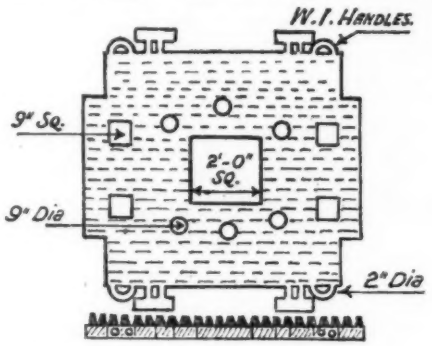


FIG. 10.—TOP PLATE AND SECTION SHOWING PRODDERS.

seat the bottom plate, and to clamp the job down. Eight of these bars had to be made, four for the bottom and four for the top. The weight of each bar was 22½ cwts., and the total weight of the eight bars was 9 tons, approximately. Setting four of these bars equally apart and levelling them off, the men now rammed cinders and coke to the height of the bars—8 in.

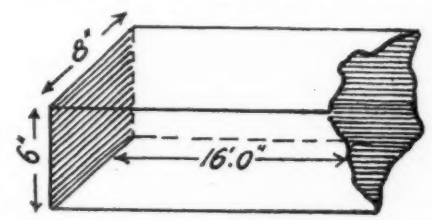


FIG. 11.—SECTION OF A HOLDING-DOWN BAR.

—and over this a 2-in. layer of straw was laid as additional venting.

Constructing the Mould.

The bottom plate was now lowered and correctly set and levelled off with a spirit level. Giving the plate a coating of clay wash, the moulders now started in earnest with the building of the mould.

In the centre of the plate a 4-ft. sq. by 4-in. thick layer of loam was well rammed, vented and levelled off. Upon this the pattern was now seated and centred, care being taken to see that the dovetail core-print correctly sat over the two 6-in. holes in the plate, as it is only by means of these two holes that the core could be bolted down in its print. The mid-plate and joint-plate were now set as a trial (by means of packing) and the top plate lowered on, and the positions of runners and risers checked.

Everything being satisfactory, the pattern was reset and centred and weighted down with a ton-weight and the building started, and Fig. 12 represents the job at this stage. The building was carried to within 4 in. of the pattern, using bricks and slurry, whilst the loam was well rammed and reinforced with rods and nails. In the brick spaces cinders were added. The approximate number of bricks used to the fourth layer was 350. On completion of the fourth layer, four large wooden ingates were laid in position, each 6 ft. long by 4½ in. sq., tapering to 4 in. sq. at the pattern end, 4 in. of loam being allowed round the ingates. The fifth layer of brick was built up and the wooden ingates taken out.

The pattern was also withdrawn to permit of

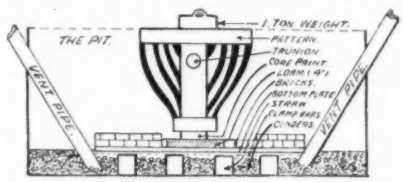


FIG. 12.—FIRST STAGE OF BUILDING THE BLOCK.

sprigging the bottom. The ingates, too, were sprigged, were now blacked off, finished and skin dried. When thoroughly dried, over the ingate openings, eight large loam-cake cores were set, rods being used for fastening them in posi-

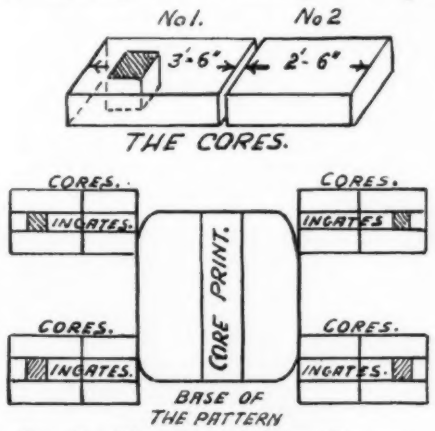


FIG. 13.—METHOD OF COVERING INGATES.

tion. The joints were wet loamed where core met core.

Two cores were used over each ingate opening, a large and a small core (Fig. 13 shows the two cores used and how they were fitted). The downgates, 4½ in. sq., tapering to 4 in. sq., and 6 ft. long, were now set tightly in the downgate openings in the cores and firmly wedged. Using approximately 300 bricks a layer, the halfway stage (9th layer) was quickly reached. The job was now about 3 ft. up, and here the mid-plate was set by bedding it in a layer of slurry. At this stage approximately 3,000 bricks had been used, and before the joint was reached another 1,000 were used. A further nine layers of bricks saw the job within 5 in. from the top of the pattern. Here the joint plate was set and bedded in, and on the joint plate a 3-in. layer of loam was well rammed to the pattern level. At the corners of the joint four 3-in. sets were let in, and two on each side, equally apart, to take the actual weight of the top off the joint and prevent crushing.

Sixteen of these cast-iron sets were used altogether, eight on the joint and eight on the top plate. The joint face was well sprigged, levelled off, the runner sprays cut and the pattern withdrawn. The mould was well sprigged all over and dried. Due to its huge size stoving was impossible, so a special fire-devil was built for

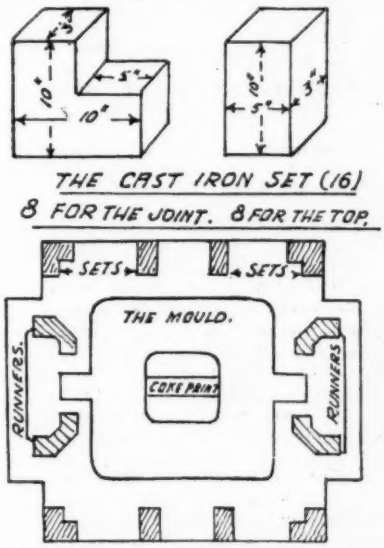


FIG. 14.—SHOWING SETS AND RUNNERS.

it, closely following the shape of the block. This was made by making two gratings, a large one for the top and a smaller one for the base, and casting in wrought-iron rods bent to the pattern's shape. This specially-made coke-devil was fixed up and allowed slowly to dry the mould, taking three or four days thoroughly to dry the job. Cleaning the mould out, the job was filed and blacked off, and the dove-tail core at the bottom fitted in and bolted by means of bolts, through the plate and fastening, to the

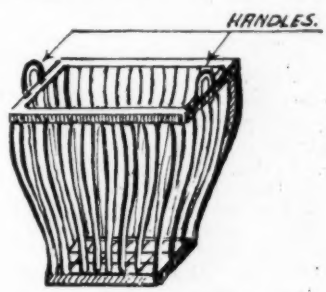


FIG. 15.—SPECIAL FIRE-DEVIL.

core grating. The mould was skin dried and left. Fig. 14 shows the joint of the mould at this stage, with the cast-iron set blocks and sprays cut, and Fig. 15 the special fire-devil used in drying the mould off.

The Top Part.

The mould being complete, a start was made on the top portion. This was soon done, and presented no difficulties. Claywashing the top plate, a thin layer of straw was laid in between the prodders, and the prodders wired. Round the risers, runners and feed-head openings in the plate special gratings were made and set for strengthening these positions. The whole was well rammed with loam 3½ in. high, or ½-in. over the prodders, and the sets let in. The whole was well sprigged with 3-in. spriggs, vented, and strickled off, by using two old steel rails. A large fire was built over the job on some scrap-metal sheeting, and the job was allowed to dry slowly. When thoroughly dry

D

the top was filed off and blacked and skin-dried. Turning it over, the risers and heads were rammed up. The centre feed head was rammed up in two moulding boxes to a height of 26 in. with an 18-in. dia. head, whilst the risers were made 15 in. high with 9-in. dia. heads tapering to the base to 2 in. dia.

These were blacked off on the top and dried,

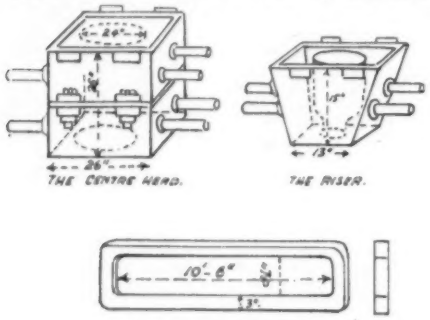


Fig. 16.—Details of Main Feed Head, Riser and Stirrup Clamp.

and the job was now ready for closing. Four large loam-cakes, 15 in. by 12 in. by 6 in., were set up and fastened to the ingate openings and wedged by using weights, and the joints loamed over. For clamping, eight large wrought-iron stirrup clamps had been made, these were approximately 10 ft. 6in. by 8½ in. by 3 in. square, weighing 5 cwts. each. These were now set on to the bottom holding-down bars, fixed and wedged there by means of packing and bolting

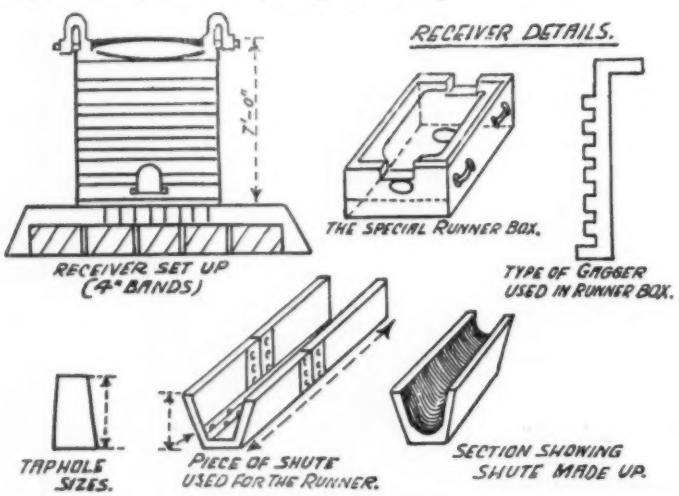

RECEIVER DETAILS.
2'-0"
RECEIVER SET UP (4" BANDS)
THE SPECIAL RUNNER BOX.
TYPE OF GAGGER USED IN RUNNER BOX.
TAPHOLE SIZES.
PIECE OF SHUTE USED FOR THE RUNNER.
SECTION SHOWING SHUTE MADE UP.

Fig. 17.—Receiver Detailers.

them on the bar. In the lug-holes four special bolts were used, 12 ft. long by 1½ in. dia.; these were set in the bottom-plate lugs and bolted, and allowed to remain loose until the top was finally put on. Fig. 16 shows details of the main feed head, riser, and stirrup clamp.

Whilst the mould was in making, work had been proceeding and tackle had been made for casting it. This brought along further difficulties. For casting, it required an iron that would not quickly solidify as it was calculated that at least 40 tons would be necessary, and to melt and have this amount sufficiently fluid would take no little time. Accordingly, a number of mixtures were run off and times taken and tests made as to suitability for the job. It was finally decided that a mixture with a silicon content of 2.21 per cent. would serve.

This difficulty settled, the management now had to settle the remaining question "How were they to cast it?" This itself was no light task, as the biggest ladle available was only 15 tons, the next largest in use being a 7-ton ladle. This difficulty was eventually overcome by converting an old scrap boiler and making it into a receiver capable of holding 20 tons. An opening for a breast-plate was made, and handles added for lifting. It was daubed with an inch coating of ganister and bricked up, the bottom with 3-in. bricks sloping to 2 in., and filleted all round, and inch bricks on the side. It was dried and blacked off, and refired, and left until required. Two other ladles, a 15- and 7-ton, were prepared. The receiver was set in position as near as possible to the mould and cupola. The nearest possible point to the runner box was 32 ft. It was set approximately 2 ft. 6 in. above the height of the runner box, the height from top-hole above runner box being approximately 3 ft. 3 in. To prevent it sinking, moulding boxes filled with sand were used to pack it up, and four cast-iron bars 6 ft. long by 5 in. square were made and placed across the boxes. The whole was well rammed and the receiver set on it. A quantity of steel gutterings were bolted together, one length of 32 ft. for the receiver-to-runner box, and the other 16 ft. long to fit from the opposite side of the runner across to the other bay where the crane was positioned. These gutterings were now made up into runners, blacked and fired and placed in their respective positions, by packing them up underneath with moulding boxes and sand. The slope being approximately 1 in 10, a special runner box to take these runners had to be made, with deep slots to enable the runners to seat correctly. Special gaggers, too, were required for the runner box. The two runner boxes were rammed up and vented, dried and blacked. Preparations, too, were made for casting; 42 tons of metal was loaded up on the charging bank and divided amongst the cupolas as to 12, 12, 9 and 9 tons. Fig. 17 gives the receiver details and methods of building it up, and details of the guttering used to make the runners, whilst Fig. 18 shows method used in fixing up the runners from receiver-to-runner box, and of the shorter pieces set at the opposite side.

The mould was now cleaned out thoroughly and washed over with a mixture of molasses and core-gum, and cracks filled in. A joint was made by putting a mixture of oil and sand round the outline of the mould, and also to prevent a possible burst-out. The top was first tried on, and being correct, lowered in position, and the joint daubed up. The bolts were passed through the lug holes and tightened, top clamping bars put on and the stirrups set over them

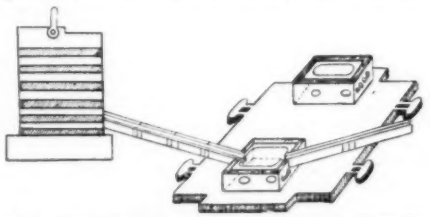


Fig. 18.—Receiver with Runners Set In Position in Runner Box.

and the whole wedged down. For this job a hundred wedges were needed. Round the feed head and risers a coating of thin loam was put and the heads and risers set in position. The two runner boxes were set on a loam jointing and large loam-cakes formed the base of the runner boxes, for the metal to fall on. These runner boxes were 6 ft. by 5 ft. by 2 ft., and to prevent the possibility of their moving during the cast, clamps were made and used with pieces of rails

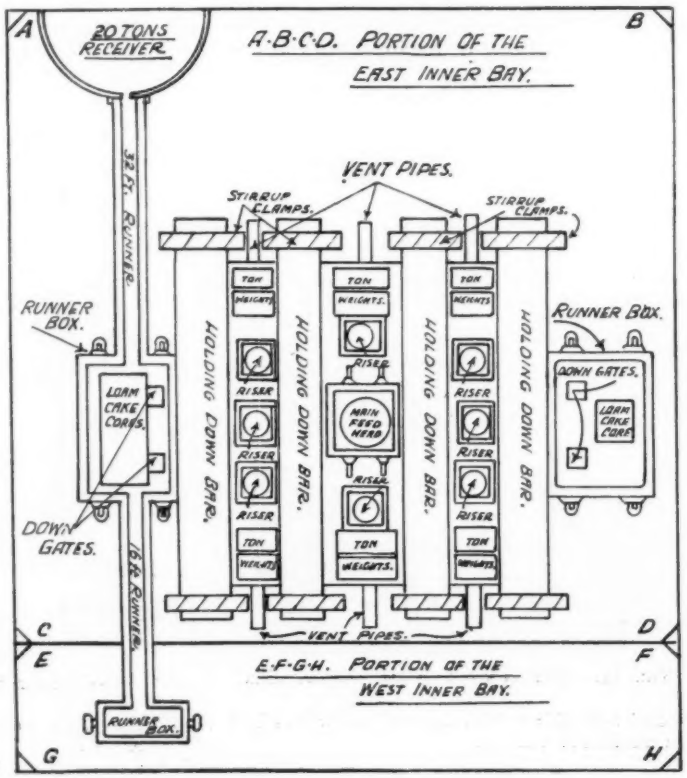


Fig. 19.—Mould Ready for Casting.

The pit was filled in and well-rammed, for safety's sake, as well as working convenience, as no one wanted any accidents during the casting operations.

As it is better to be sure than sorry, it was decided also to use weights, so the job was heavily weighted and Fig. 19 shows the job weighted and clamped ready for casting.

In the downgates heavy plugs or stoppers were fitted in and there was not anything further to

be done until the metal was ready. Blast was put on the four cupolas at 4 p.m. and the first metal tapped at 4.30 p.m. As the metal was tapped it was taken in ton ladles and emptied into the 15- and 7-ton ladles. When these were full they were emptied in turn into the big receiver.

The receiver, holding just over 20 tons of metal, was covered over with charcoal to keep the heat in; 2 cwts. were used. Metal was now taken and emptied in the 15- and 7-tons ladles; when these were filled all was ready for casting. It had approximately taken 2½ hrs. to melt

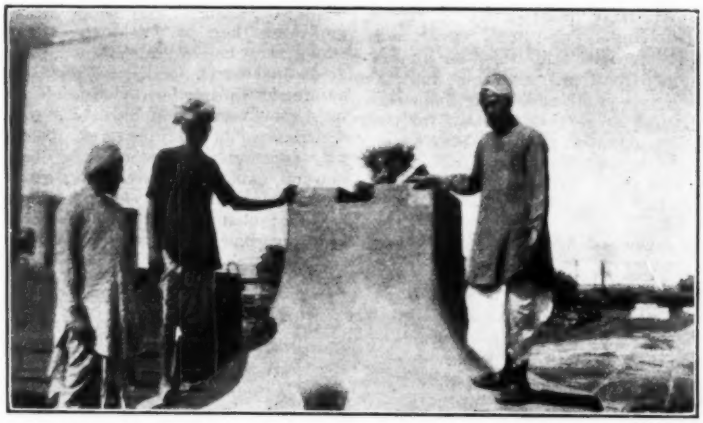


FIG. 20.—THE FINISHED CASTING.

42 tons, the three cupolas being dropped as they melted their quota, the fourth being kept on in case more metal was wanted.

Casting proved an easy task, the receiver being tapped and simultaneous pouring conducted from the 15- and 7-tons ladles. The plugs or stoppers were lifted as soon as the runner box was full. A good head of metal was kept going in the runner box. In fact, it was as much as one could do to keep the runner box full. The tell-tales in the covers on the risers and feed head soon indicated she was nearly up, the covers were pulled off and the pouring eased. It was all over in five minutes, and had passed

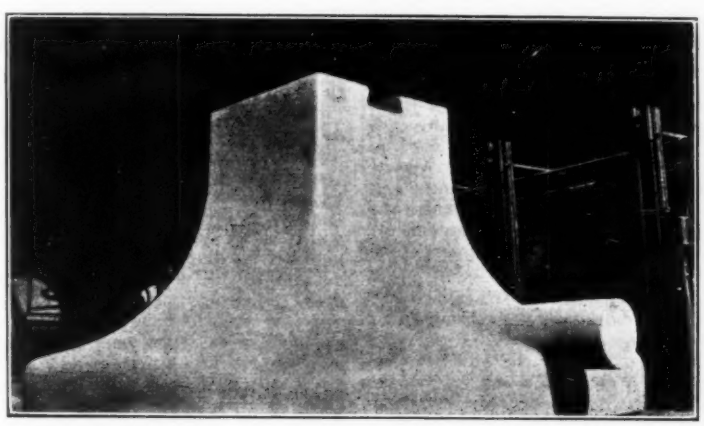


FIG. 21.—CLOSE-UP OF THE FINISHED CASTING.

off successfully. For two hours relays of eight men were kept busy feeding it, and as the metal in the head cooled down fresh metal was continually added to keep it fluid for feeding.

After the feeding, the heads and risers were lifted off by the crane, as much as could be broken off, and then the runners were broken off and knocked down. The mould was then eased by removing the wedges and easing the bolts. To remove the block from the mould, the plates were taken off and mould smashed up, whilst jacks were used to ease it. From the fettling section it was eventually shifted and loaded on a steel truck by a 60-ton breakdown crane loaned from the erecting-shop department.

On weighing it scaled just over 32 tons 5 cwts., and was a beautiful casting to look at. Outwardly there was not a blemish anywhere. Figs. 20 and 21 show the finished casting.

The following inventory may, perhaps, give a better idea as to the immensity of the undertaking:—

(1) Approximately 4,000 bricks were used in its manufacture.

(2) The digging up and removal of some 3,200 cub. ft. for the pit to build it in.

(3) The making of a 20-ton receiver for casting it.

(4) The making of 4 plates on which to build it, weight approximately 30 tons.

(5) The making of 8 holding-down bars, 9 tons (22½ cwts. each).

(6) The making of 8 stirrup clamps (2 tons) and four 12-ft. long by 1½-ft. D. bolts.

(7) The making of 4 bars for seating the receiver, 1½ tons (7½ cwts. each).

(8) The making of 2 runner boxes weighing 1 ton (10 cwts. each).

(9) The making of 16 set blocks, 8 cwts. (½ cwt. each).

(10) The making of 4 square plugs, 1 cwt., for the runner boxes.

(11 The making of 100 wedges, for packing purposes.

(12) Five cwts. of spriggs.

(13) Two cwts. of charcoal for the receiver.

(14) 48 ft. of steel guttering for the runners.

(15) Cutting up approximately 40 ft. of old rail (for making beds for the plates.)

In addition, innumerable incidentals, such as gaggers, wrought-iron handles, battens for downgates and ingates, and for striking-off purposes, rods and bars, cores, loam cakes, straw, coke, coal, cinders, etc.

In conclusion, the author wishes to thank the Deputy Chief Mechanical Engineer and Works Manager (Manufacturing), to whom he is greatly indebted for their kind permission to use the facts and information relating to the foundry and railway.

Publications Received.

Dundee.—MR. EDWARD R. CROSS, of Cross, Courtenay, Limited, St. James' House, Brazenose Street, Manchester, having been entrusted by the Dundee City Development Committee with the production of a brochure setting out the advantages of the town as a suitable centre for the institution of new industries, has sent us an advance copy. It is the most elaborate and beautiful piece of publicity we have encountered for a long time. It was a happy thought to bind the book in jute, to relieve it with rectangular golden plaque. Undoubtedly, Dundee is an excellent centre, possessing manufacturing and trading facilities of a unique character, especially in regard to distribution. Gas and electricity charges are not set out in such a manner as to afford proper comparison with other cities. However, the matter is interestingly presented, that inquirers will almost automatically write for quotations, which, after all, is the object of this effort in publicity. Finally, we heartily congratulate the compilers on their artistic and comprehensive achievement.

Nickel Bulletin for January, 1932. Published by the Bureau of Information on Nickel, The Mond Nickel Company, Imperial Chemical House, Millbank, London, S.W.1. In addition to a long article on heat-resisting cast iron, the subject of a lengthy abstract in our columns, this issue also covers the London County Hall, a new Bristol Double Decker and the usual abstracts, references and patents.

Conversion Tables.—MR. HAROLD BULL, of Messrs. Bull's Metal & Melloid Company, Yoker, Glasgow, has sent us a booklet for converting, by tables, lengths ranging from 1 to 8,000 mm. into feet, inches and 32nds of inches for each millimetre increase. We personally shall find this useful in converting test-piece sizes and deflections of Continental origin into standard British measurements. It costs only 1s. 8d. post free.

Conversion Graph.—Messrs. High-Speed Steel Alloys, Limited, of Dillon Road, Widnes, Lancashire, has prepared a wall chart for the ready conversion of fluctuating sterling in U.S.A. dollars and *vice versa*. We hope that its great immediate utility will be short lived.

High-elastic Nickel Steel for Ships.—High-elastic nickel steel developed in the United States recently for shipbuilding purposes may be utilised in two super-liners which have been designed for the United States Lines and which are expected to be built ultimately for North Atlantic service. Tests of this material, plates of which were rolled for and sent to the Newport News Shipbuilding & Dry Dock Company, Sun Shipbuilding & Dry Dock Company and United States navy department, were witnessed by representatives of the American Bureau of Shipping and Lloyd's Register of Shipping, and showed the following average properties: Tensile strength, 40.44 tons per sq. in.; yield point, 23.21 tons per sq. in.; elongation in 8 in., 20.3 per cent.; reduction of area, 43.2 per cent. The average Brinell hardness is 179. Six specimens having welds across the test length broke in the weld at an average stress per sq. in. of 39.55 tons. The average elongation of these six pieces was 8.7 per cent. The average proportional limit of 14 pieces was 18.69 tons per sq. in., the minimum being 17.36 tons and the maximum 20.88 tons.—"Steel."

Institute of British Foundrymen.

FIRST ANNUAL DINNER OF THE WEST YORKSHIRE BRANCH.

The first annual dinner of the West Riding of Yorkshire Branch of the Institute of British Foundrymen was held on January 9 at the County Restaurant, Bradford. Mr. A. S. Worcester (Branch-President) presided over an attendance of some 55 members and ladies.

The chief guests were Mr. A. Harley (President of the Institute) and Mr. H. Richardson, (Principal of the Bradford Municipal Technical College).

A Branch Milestone.

Mr. S. W. Wise (hon. Branch-Secretary), in proposing the toast of "The Visitors," said he proposed it with particular satisfaction. The Branch had been in existence for a matter of ten years, but this was the first time they had organised a dinner. It was a milestone in their history, and he had every hope that it would be the first of a long series of annual functions. The Institute did wonderful work, but it had few favours to bestow. Its greatest honour was the Presidency, and in Mr. Harley they had a man fully worthy of the high position to which he had been elected. They were glad to welcome Mr. Harley to West Yorkshire for the first time. Mr. Harley had special reason to be proud of his term of office, since it was marked by that important landmark in the progress of the Institute—the establishment of the foundry and patternshop apprentices' tuitional charter.

Since the inception of the West Riding Branch, Mr. H. Richardson, Principal of the Bradford Technical College, had given much help and encouragement by allowing the use of the College for Branch meetings and for the housing of their technical reference library. He had gone still further, and was one of their warmest supporters in the apprenticeship training scheme.

The President Responds.

The President of the Institute (Mr. A. Harley), responding to the toast, said he believed it was some time since there was a Presidential visit to the West Riding Branch, and he was glad to be privileged to renew such visits. The chairman and secretary of the Branch were old friends of his own, and were both doing a vast amount of good work on the General Council of the Institute. He was glad, also, to come to West Yorkshire because it was one of the smallest, yet among the most virile, of the Branches, and he felt that such Branches were deserving of every possible help and encouragement. He did not wish to be unduly flattering, or to cast any disparagement on other Branches, but from his own knowledge of conditions he was prepared to say that the West Riding Branch was one of the best-managed and most enterprising, especially in view of the size of its membership and its widespread area.

The Branch was very sound financially, vigorous in its activities, and had the lowest aggregate arrears of the Branches and a very low figure of arrears per member. No Branch had taken a more enthusiastic part in the promotion and encouragement of the National Certificate scheme, and it had gone to a good deal of trouble to popularise that scheme in the industry.

Mr. Harley was delighted to hear of the close co-operation between the Branch and the Bradford Technical College. That was a very important factor in their hopes of educational progress in the West Riding. In some respects the Institute was unique. He believed they were the only technical and scientific association which had a membership representing every grade and phase of the industry, from managing directors down through the ranks of scientists, technical men, practical men on the works and the operative himself, all in one great and valuable organisation, the sole objective of which was to improve the status of the industry and everybody in it. He had one day taken the trouble of working out the grades of foundry and patternshop work represented in the Institute's membership, and found the grades numbered no less than 35 in their membership of 2,000. The Institute could therefore say with truth that it represented the entire industry, from top to bottom. They met together for one reason only—to advance their knowledge of the craft, though by getting together for that purpose they also achieved the very real benefit of social intercourse and cementing friendships. The Institute had three Branches in Yorkshire, and it was proud of them all.

Educational Activities.

Mr. H. Richardson, Principal of the Bradford Technical College, proposing a toast to the West Riding Branch of the Institute, said he regarded the officers and committee of the West Riding Branch as his very good friends. They had been associated now for some time, and at the College they had a warm regard for the Institute and particularly for the Branch with which they were more especially in touch. They recalled the good work of Mr. Liardet, its first President. To his mind the manner in which the members maintained consistently good attendances at the monthly Saturday meetings, most of which were held at the Bradford Technical College, said a great deal for the enthusiasm of the members.

Mr. Richardson took the opportunity of expressing his thanks to the General Council of the Institute for the gift of the "Proceedings" of the Institute, offered for the library of the College at Bradford. The College authorities wished the Institute to know that that was warmly appreciated, and they hoped the Institute's association with them would continue. To the speaker's mind, one of the most important works undertaken by the Institute was the new National Certificate tuitional scheme. "The adult in industry," he said, "has more or less got into his general line of work, and we on the educational side are chiefly interested in the adolescent rather than the adult. It is not needed to remind people engaged in industry of the plain fact that the young apprentice, when he enters the engineering shop, is not exactly overwhelmed with encouragement to make himself better equipped for his job. We know that perfectly well, and we also know of the difficulty there is in getting a sufficient supply of the competent young men."

In endeavouring to meet the situation in the interests of the young men, he believed the Institute was doing a very great work. The work which had been done by the Advisory Committee on foundry practice had been very highly thought of by the City and Guilds of London Institute, and the establishment of National Certificates on lines practically identical to those established for the Institution of Mechanical Engineers should prove of immense value in the training of young foundrymen.

The Institute of British Foundrymen had done valuable work in encouraging this development, in fostering research and in taking every possible opportunity of furthering the extension of knowledge of foundry problems and difficulties. It was of especial value to the country at the present time, for if we could make our primary industries once more prosperous, we could look forward to a real improvement in the general welfare of the people.

An Ancient Art.

Mr. R. D. Welford (Senior Vice-President) responded to the toast. He believed the Branch officers and members had worked hard and consistently enough to feel that the complimentary things said about the Branch were to some extent really deserved.

The foundryman's calling, he said, was one of the oldest in existence. The work dated back to the time of Tubal Cain, and examples of cast-iron work had been found during the excavations at Ur of the Chaldees, dating 3000 B.C.; in the British Museum were specimens of foundry-work of 800 B.C. One often wondered what kind of men were these early foundrymen, and how they had achieved the technique by which they had produced splendid work, lasting down through the ages, without scientific advice as known in modern times. They must have been men very much like the "practical man" of to-day, as distinct from the scientifically-trained man; men who by experience had learned cause and effect of certain operations without scientific or exact knowledge of the reasons; men who knew how to apply without knowing how that certain results came from certain application. Even to-day engines were working which had been made over 100 years ago.

But there was no doubt that science was of the greatest importance to industry to-day, and for that reason the Institute and its work was of paramount value. As had been remarked, its membership embraced every grade in the foundry industry. One would like, however, to make a plea for more practical support and assistance from the leaders of the engineering trades in the West Riding. The Branch had comparatively few subscribing firms, and they did not get as many heads of firms to the Branch meetings as they would like. The members generally would greatly appreciate their presence and advice, and there was little doubt that they, in return, would probably learn something to their advantage as to the difficulties and problems which were inherent in the daily work and which were not, perhaps, always apparent to controlling authorities. Mr. Welford appealed for increased general membership for the Branch; he believed there was in the area ample scope for a membership of at least 200.

Classes are Valuable.

The Branch had reason to be grateful for the support given them by the Bradford Technical College authorities. Unfortunately, it was true in the foundry industry, as in many others, that numbers of youths entered into it whose only apparent place in life was heavy labour; they seemed to have no incentive to embark on further education which might lift them into higher grades. Some of them, when the training facilities offered were mentioned, asked "Of what use will it be to me?" One presumed that a young man who had better knowledge of his craft would be able, in due course, to fill a better post; but even supposing that he did not benefit financially, it was surely an advantage to be able to do one's work with some degree of knowledge and greater interest instead of doing it like a horse, which was told to pull and pulled without knowing why. One young man to whom the speaker had talked about the National-Certificate course, said he did not see how he could learn in a class more than he had learned in six years in the foundry. Mr. Welford brought this young man a copy of the examination papers of some foundry classes which had been running a season or two elsewhere, and asked him how many of the questions he could answer. In order not to overwhelm him, he gave him a week in which to deal with them at leisure. At the end of the week the youth admitted that out of the 14 questions there were only two which he *thought* he could answer, and was astonished when it was pointed out to him that there were

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Some Jobbing Foundry Moulding Jobs.

By J. H. List.

Founders engaged in producing special lines in mass quantities will find that the jobs described below, which are typical of the work produced generally in jobbing foundries, differ considerably from their own work. The jobbing founder usually has to produce castings from makeshift patterns, and in many cases from spindles and stickles, but it does happen that for some work proper patterns have to be supplied.

Ejector Water Heater.

The first job to be described will be that of an ejector water heater, cast in a zinc-free alloy. The main pattern was in halves, and a set of six core-boxes had to be made to make the casting. The two illustrations clearly show the mould in process of coring up (Fig. 1) and ready for the top box to be put on (Fig. 2). It will be seen that the moulding was simple. The making of the cores, however, was not quite so easy. They were made in oil-sand, and were in all cases made without core irons or reinforcing rods, this being done to enable the cores to be freely removed. The placing of the cores in the mould necessitated great care. They were placed in, as shown, in halves, and were jointed up in position with a good quick-drying gum. The metal was melted in a crucible pot in the usual way, and the mould was arranged with two runners. This was quite a special line, and very few were required.

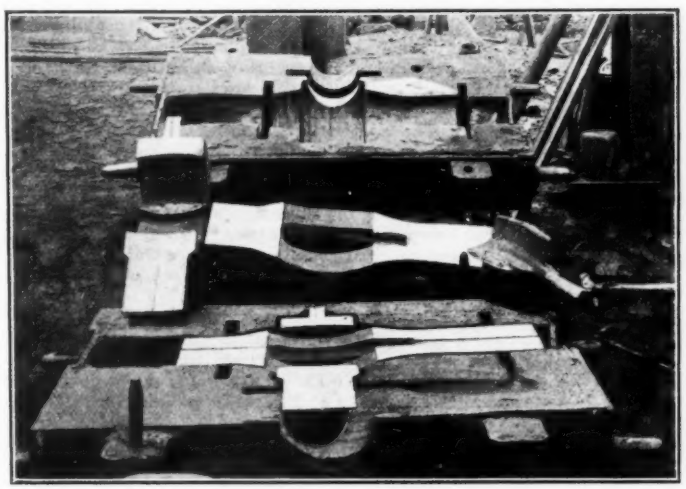

Fig. 1.—Mould being Cored Up.

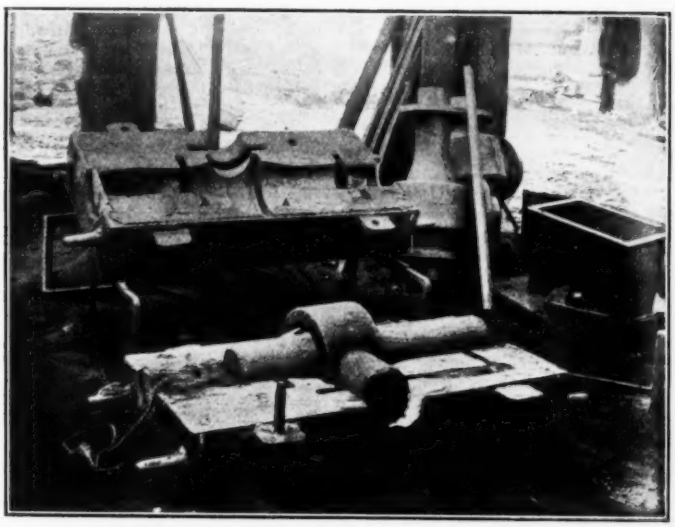

Fig. 2.—Mould Ready for Closing.

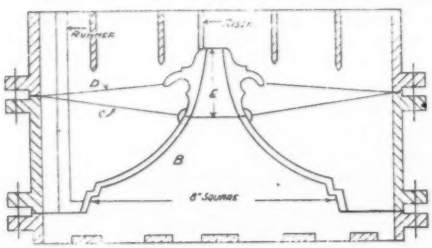

Fig. 3.—Section through Vase Pedestal.

Moulding a Vase Pedestal.

The next job to be described is a small cast-iron vase pedestal, which presents several interesting points in the moulding. Such castings, of course, have to carry a good finish, as they are used as ornaments. Fig. 3 shows the mould ready for pouring. It was made in a three-part box, as shown. The bottom was rammed up and vented and strickled off level. Then the centre part of the pattern B was rammed up and vented and turned over on to the bottom box. The joint was then finished off, and the next part put on. This part was rammed up to the joint C, that is, to the centre of the small head, which head was loose on the pattern. The top portion of the pattern was then placed on, and a joint D was made, the sand being well tucked under the cup shape. Next the ramming-up of the inside was completed, and vented down to the bottom. The top box was placed on and rammed up. The runner was cut as shown, also a small riser or whistler should be formed. To extract the three parts of the pattern the top box was lifted off and the top part of the pattern taken out; the top box was replaced, clamped to the second. These two parts were lifted off at the same time and turned over on to a board or bed. The clamps were taken off and the second box lifted off, and the ring or head pattern taken out. One then proceeded by replacing the second box and then clamping it to the top box as before. The bottom part of the pattern was taken out. That part of the green core E could have come out with the top part of the pattern, if it had done, it would have had to be taken out carefully and placed back on the top of the main core at this stage. The two top boxes, still clamped together, were replaced. The clamps were taken off and the top box lifted off, to examine the core E, to ensure it was in the correct position. The mould was then ready for closing and running. This job it will be seen was quite interesting and rather difficult. Very few castings are required from such a pattern.

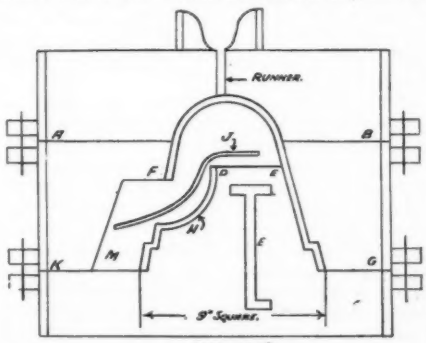

Fig. 4.—Section through Grease Trap.

A Grease Trap Casting.

The last example is that of a small grease trap. Fig. 4 shows a section through the mould ready for pouring. It is commenced by placing the pattern downwards on a board and then placing the middle box on and ramming this up, and making a joint at AB. Next place on the top box and ram up this, cutting the runner as shown. Clamp these two parts together and turn them over; take off the board and make a joint DE; extend this joint down to FK, to the joint of the middle box. This joint must be papered. Now place on the loose lip H, and ram this carefully to ensure it is correctly rammed, lift off the lip. If satisfied, replace the lip, first pressing in position the four bent wires, as shown at J. These must be well oiled so that the sand will adhere firmly; these are put in to hold the sand M from collapsing when it is turned over. Next make the box joint KG and place on the box and ram up; then insert the lifter to stiffen the projecting sand, which requires well venting. Proceed by lifting off the box part and take out the lip pattern, replace the box part, clamp the box parts together and turn over the mould. The mould is now in the correct position for pouring. Now lift off the top box, clean out the runner, take off the middle box and draw out the pattern. The mould may now be closed up. The patterns, by the way, are of metal. These castings must be very clean all over, because they have to be stove-enamelled white. This job also is an interesting one, and a good moulder will make about three in two hours.

The funeral of the late Mr. H. C. Dews, President of the London Branch of the Institute of British Foundrymen, took place at Horbury, near Wakefield, on January 27. Mrs. Dews and Mr. Norman Dews (brother) were the principal mourners. The Institute of British Foundrymen was represented by the General Secretary (Mr. Tom Makemson), and Mr. F. W. Rowe, Mr. J. E. Hull, Mr. F. Kelham, Mr. G. E. France and others who had been associated with him were present. Wreaths were sent by the London Branch of the Institute of British Foundrymen, the President and Council of the Institute, the London Local Section of the Institute of Metals, and Mr. Wm. Jolley, Convener of the Technical Committee of the Institute of British Foundrymen.

Heat-Resisting Cast Iron.*

There is now available a range of heat-resisting alloy cast irons, whose properties, while inferior to those of the heat-resisting alloys proper, are nevertheless much superior to those of the various types of cast iron previously available. Cast iron is employed in many engineering applications on account of its low cost and the fact that it can be readily cast into the required form. Its normal life at elevated temperatures, however, is short, since it rapidly deteriorates through oxidation and burning away. At the same time, cast iron has the peculiarity of growing in volume, even to the extent of as much as 20 or 30 per cent. This, in turn, results in further troubles, such as inevitable distortion in the part concerned, accompanied frequently by damage to other structural members with which the iron is in contact, as, for example, refractories used in furnace construction.

Effect of Heat on Cast Iron.

On heating cast iron, a critical range of temperature is met between about 750 and 900 deg. C., in which the combined carbon changes its form, being dissolved in the free iron present, while some of the graphite also goes into solution. The reaction is accompanied by considerable volume change, but, on slow cooling, this is normally reversible. If, however, the change takes place rapidly on heating or cooling, then it may result in stress in the metal, with the consequent formation of minute internal cracks.

It was at first thought that growth was limited to castings subjected to temperatures in or above the critical range. As pressures and temperatures in general engineering practice increased, however, it became apparent that the effects of heat on cast iron manifest themselves at much lower temperatures. For example, cast-iron steam valves and chests working at no more than 450 deg. C. showed that under these conditions, ordinary cast iron was liable to grow in time, and to become internally oxidised, thereby losing its strength and becoming unreliable in service.

In many heat-resisting applications, the scale which is formed on the surface of the metal by oxidation may be removed almost as fast as it is formed, and actual wastage of the castings then takes place comparatively rapidly. For example, in such applications as chain-grate stokers, any scale formed may be immediately removed by abrasion; while in cases where the cast iron is in contact with ash left by the fuel, the scale may be slagged away by combining with the ash to give a fluid slag which either runs away immediately from the firebars, or is broken off on cooling. In either case a fresh clean surface of the iron is exposed to further attack.

The effects of heat on cast iron have now been studied for a number of years, and while surface oxidation is not difficult to understand, there has nevertheless been a considerable amount of controversy concerning the mechanism of the phenomenon called "growth." As a result of recent researches, however, it is now generally accepted that "growth" is due principally to the three following factors:—(1) Decomposition of the combined carbon present into the graphitic form, this taking place generally at temperatures just below or just within the critical range mentioned above; (2) internal oxidation of the metal proceeding initially along the graphite flakes, the latter having been coarsened, and in some cases, initiated, by (1); and (3) internal cracking of the metal consequent on localised volume changes such as are produced by oxidation and by structural changes occurring in the critical range, followed by further oxidation through the cracks formed.

Heat-Resisting Cast Iron.

It will be clear from the above that in the development of heat-resisting cast iron, first consideration must be given to the prevention of internal oxidation of the metal through the graphite flakes, while at the same time, if possible, the metal itself must be rendered less liable to oxidation, so that surface attack by the atmosphere is minimised.

In the case of ordinary cast iron, little scope is available for controlling the tendency of the metal to oxidise on the surface, but a considerable measure of control can be maintained in preventing internal oxidation. This is effected principally by minimising the development of coarse graphite flakes and by preventing their growth at high temperatures. This leads logically to the conclusion that the best heat-resisting cast iron would be white iron, which, of course, contains no graphite, and white iron is, in fact, more heat-resistant than any of the various available grades of grey cast iron.

Unfortunately, white cast iron suffers from the disadvantage that it is hard, unmachinable and tends to be brittle. Consequently, where these properties render the use of the white iron inadmissible, grey cast iron must be employed. In the development of grey heat-resisting cast iron, due attention must therefore be given to the prevention of the development of coarse graphite.

The structure of cast iron is dependent, in the first place, on the composition of the metal, especially with regard to such controlling elements as silicon. In ordinary iron, silicon exerts a powerful influence in promoting the formation of graphitic carbon from the combined form, and in white cast iron silicon must, in general, be kept low. It follows that in heat-resisting castings, silicon should be maintained as low as possible in order to prevent the development of coarse graphite. Other elements present in the iron also exert an influence on carbide decomposition. For example, increasing manganese and sulphur tend, contrary to the effect of silicon, to promote the retention of the combined carbon, and, therefore, favour heat-resistance, but at the same time these elements render the iron hard and unmachinable.

Use of Nickel in Heat-Resisting Cast Iron.

Nickel, while acting similarly to silicon in rendering an iron grey, does so whilst maintaining a fine structure with a dispersed form of graphitic carbon. Moreover, the action of nickel is much milder than that of silicon, and thus assists in preventing the growth of coarse graphite in service.

It has been shown elsewhere* that the fundamental influence of nickel is to eliminate chill in a casting, thereby conferring uniform machinability. One of the principal virtues of nickel, therefore, in connection with heat-resisting cast iron, is that it enables full advantage to be taken of the effect of having a low-silicon content, while giving castings which are uniform and machinable. Castings with low silicon, both in grey and white cast iron, tend to be brittle and show trouble with cracking when heated locally. The addition of nickel to the metal under these conditions adds toughness and strength under shock, and acts virtually in these directions to replace part of the silicon content normally occurring in the castings.

Use of Chromium.

The addition of chromium to cast iron is generally found to improve the heat-resisting qualities of the castings by rendering them more stable, as in the case of a silicon reduction. Chromium, however, also increases the tendency of the iron to chill, and renders the castings hard and unmachinable. In order to obtain the full benefit of chromium, therefore, it is necessary to balance its chilling effect by a nickel addition, the nickel once again serving to keep the castings uniformly grey, tough and machinable. The best results with the nickel-chromium addition are obtained when the silicon in the castings is as low as possible.

Austenitic Cast Irons.

In many applications, nickel or nickel and chromium additions have been used in controlled qualities of cast iron in order to give superior heat-resistance, due primarily to increased stability of the structure and refinement of the grain. Some benefit is also derived by the increased resistance to oxidation.

A special class of heat-resisting cast irons has now been developed in which, due to modification of the structure of the metal, critical structural changes with their accompanying volume change have been eliminated, and at the same time the matrix of the iron possesses improved resistance to oxidation. This result is obtained by using the iron in the so-called austenitic condition, this being produced by the addition of sufficient alloys to bring the critical range normally associated with cast iron below room temperature.

The addition of about 20 to 25 per cent. of nickel, 7 to 8 per cent. of which can, if desired, be replaced by copper, offers the simplest method of producing this type of structure. The heat-resistance of this class of iron is further increased by the addition of chromium, this being generally permissible up to about 6 per cent. The irons in this condition not only present a good resistance to heat, but are also corrosion-resistant and non-magnetic.

One of the most successful irons of this type which has been developed contains 25 per cent. of Monel metal (nickel-copper alloy containing 68 per cent. nickel) with an addition of about 4 per cent. of chromium. This iron has given satisfactory service for furnace parts such as superheater spacers. It is also being used for furnace doors and other applications such as racks for enamelling, etc., where a material having superior properties to ordinary cast iron is desired, but where the conditions do not justify the use of the more expensive truly heat-resistant alloys.

A recent addition to this class of austenitic irons is "Nicrosilal," which has been developed by the British Cast Iron Research Association. This is an iron rendered austenitic by the addition of nickel, and containing up to 7 per cent. silicon. The iron, like others in this class, is remarkably tough and ductile, and shows very good scale-resisting properties, the latter being enhanced by the relatively high silicon; the castings are readily machinable, and are free from the general trouble experienced with heat-cracking.

Conclusion.

Cast iron owes its essential characteristics to the fact that it contains flakes of graphite precipitated throughout the body of the metal. In heat-resisting applications, however, these flakes of graphite detract materially from the value of the castings, as they provide channels through which internal oxidation of the metal takes place, this being followed in turn by volume changes which further open up the metal, and lead ultimately to a permanent increase in volume accompanied by loss of strength in the castings. The use of nickel in irons of low silicon, and in combination with chromium, enables a close and hard grade of metal with fine graphite to be employed, which, in service, shows less tendency to the formation of further graphite than in the case of ordinary cast iron. This minimises internal oxidation, and conse-

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* Extracted from "The Nickel Bulletin" of the Bureau of Information on Nickel, January issue.

* Publication B7 of the Bureau of Information on Nickel. Abstracted in our issue of January 15, 1931.

The Magnetic Moulder.

The use of electricity as a direct power-medium for moulding machinery was first applied successfully in the squeeze machines patented and built by Messrs. British Insulated Cables, Limited, Prescot, Lancs, and originally described in THE FOUNDRY TRADE JOURNAL in Vol. 43, p. 195. Previous attempts in the electrification of moulding machines always included a motor as a component part, and of such designs probably the original Pneulec machine is the most notable success. This machine is a combination of electric and pneumatic, but the magnetic moulder is 100 per cent. electric, and has no motor attachment.

The advantages of an electrically-operated machine will be fully appreciated by anyone experienced with moulding machinery. First and foremost is the fact that every machine is a complete unit and requires neither compressor nor hydraulic plant for its working. Secondly, the construction of the machine itself is simple. There are no valves, glands, packings, etc., and there are no pits, pipe lines or elaborate foundations, or, in other words, all the disadvantages of air and hydraulic are obviated. The simplicity of construction and installation, together with low power-consumption, are perhaps the most important advantages of the magnetic machine.

Low Power Costs.

Power costs are actually so low as to appear almost ridiculous. Where machines of types SS. 324, 486 and 640 are operated to produce moulds at the rate of 30 per hr., the total electricity charge for an 8-hr. production is 1.533d. Bigger machines, such as the SS. 960 and 1,280, cost 3.066d. in power when operating under the same conditions, and with electricity charged at 1d. per unit.

The type number of machines quoted are intended to convey in square inches the maximum box area the machines will squeeze, so that the SS. 486, for instance, will take a box up to 27 in. by 18 in., or its equivalent in area.

Reference to the sectional drawing and following description will explain that with a magnetic machine power is consumed only during the actual squeeze, which takes one to two seconds. The pattern draw is by gravity on the down stroke.

Referring to Fig. 1, A is the pattern table, which is slotted for attachment of pattern plate, and also provided with four slots for the stripping pins to come up through. There is a M.S. apron fixed to the pattern table, which prevents any sand getting into and accumulating on top of stripping frame and magnet pot. The outline of the machine is clean, and there are no ledges to cause sand building up.

These guide rods B are four in number, there being one in each corner. The rods are guided in brackets cast in the top of the magnet pot, and they are 6 in. in bearing when at the top of the stroke. These rods ensure accurate and smooth movement of the table. Lateral movement is, of course, impossible. The upward movement of the pattern table is caused by passing the electric current through the solenoid C.

The solenoid can be made in one or more sections according to length of movement required, and convenience in production. The electric current magnetically energises the stationary and moving cores D and E. The moving core E, in its attraction to stationary core D, imparts upward movement of the pattern table through the medium of rod F, which is made in Vickers' PMG non-magnetic material, cores being made in mild steel. The speed of movement of the pattern table is controlled by dash-pot arrangement G.

The length of stroke is determined by the distance between the moving and fixed cores. This can be varied by raising or lowering the initial position of the moving core and pattern table by means of hand wheel H. In its upward movement the pattern table also raises the stripping frame I, being attached thereto by lifting rods J. The stripping frame is guided in its vertical movement by two side rods K, which work in brackets cast on the side of the magnet pot. These rods have an oil dash pot which cushions the downward movement of the stripping frame when released. When at the top of the stroke an automatic dog-catch engages with a slot in rods K which hold stripping frame I and moulding box by means of pins L in the top position. Immediately following this action the pattern table falls, carrying with it the pattern, which is thus withdrawn from the mould by gravity on the down stroke. The fall of pattern table is controlled for speed by the oil dash pot G. After the mould has been removed the stripping frame is returned to its normal position by the release of dog-catch through the operation of a handle at the front of the machine. It will be understood that when the machine makes its upward stroke the pattern and moulds are squeezed against crosshead M.

Before starting the squeeze operation a loose filling-frame is placed around the top of the moulding box. This is for the extra depth of sand to be superimposed on the top of the box to allow for compression of the sand. The squeeze action causes pressure head M to enter the filling-frame, and press the additional amount of sand into the mould, thus giving the density required for casting. For convenience when filling the mould with sand, and again when the

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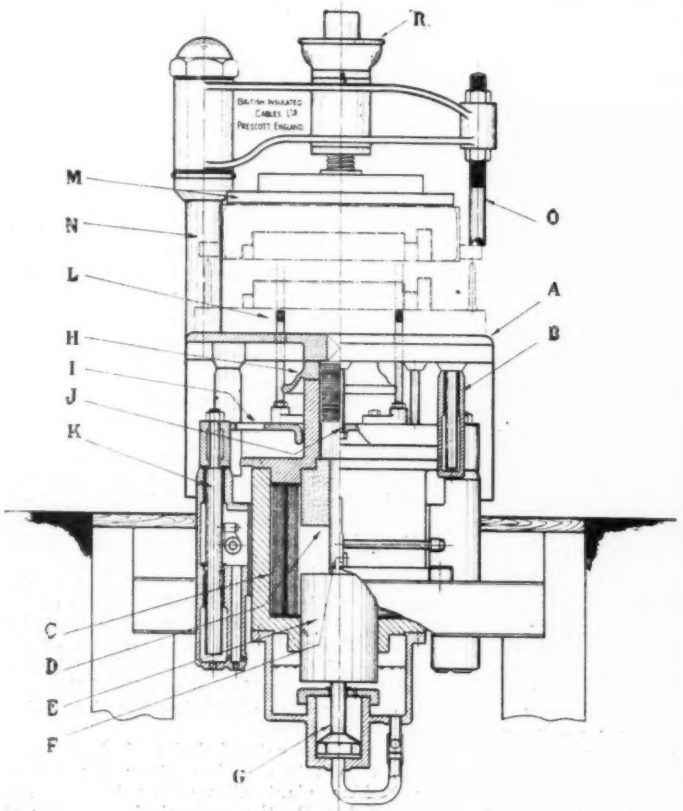

FIG. 1.—SECTION THROUGH THE LATEST DESIGN OF MAGNETIC MOULDING MACHINE.

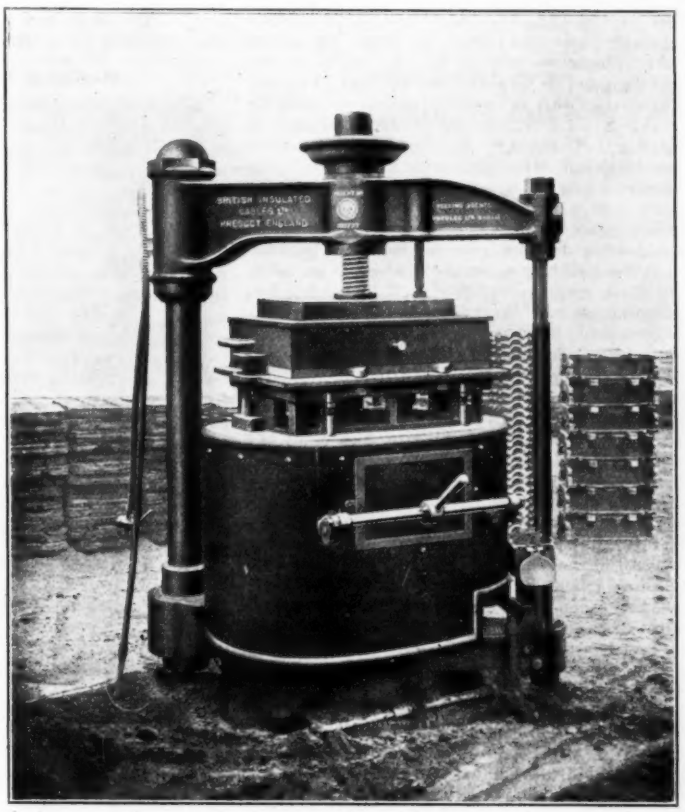

FIG. 2.—SHOWING THE NEAT AND COMPACT CONSTRUCTION OF THE NEW MAGNETIC MOULDING MACHINE.

Pipes and Progress.*

By William Phillips.

Mr. Primrose outlined in his Presidental Address the various current methods of making rain-water and soil pipes, and it is therefore unnecessary to cover that ground again, but it seems desirable to point out that in the plant under the author's management the moulds are hand-rammed and the boxes lifted from the machine to floor, cored and closed by hand. Whilst this is efficient for small output, it would not serve where large quantities are required, and could not face the competition of a large foundry laid down with the most modern machinery to turn out pipes on a large scale. Such a foundry, according to Mr. Primrose, is not so much a dream as would have appeared even when he read his Paper just a few short weeks ago.

Up to the present any attempts to produce rain-water and soil pipes by more up-to-date methods have worked along the lines of one plant designed to manufacture all sizes. It is not thought that this is either practical or possible, and this is borne out by the plants at present in operation. They have usually gone no further than 4-in. soil pipe, and where 2-in. soil pipe has been attempted by similar methods the quality and production have been such that it has not justified the expense, and in some cases the old methods have been reintroduced for that size. The problem must be tackled by studying it in three groups: (1) 2 in., 2½ in. and 3 in.; (2) 3½ in. and 4 in., and (3) 5 in. and 6 in.

The number of pipes per flask has also been a subject of experiment. Although two pipes per box have become fairly standard, larger numbers have been tried. Mr. Primrose recently gave the author a description of a plant which was making 16 per box of a small size, and eight per box of a larger size, and it is understood that four and five pipes per box method (according to size) is again to be tried out in this country shortly. One in a box has been the practice for generations, and some founders in discussing this subject have been inducing the author to advocate it, and he would like to hear of some one brave enough to return to it as an experiment. The author is convinced that more than two per box, however, is entirely wrong, and those attempting it will find they are losing ground.

There are several methods in which the problem of reducing costs of manufacture can be attacked:—(1) The production of a plant designed to do all the job mechanically; (2) a plant designed to do the moulding and core-making only by mechanical methods, and (3) adapting the present hand methods to mass production.

Mechanised Manufacture.

Method No. 1 would be eminently satisfactory for the production of 3½- and 4-in. sizes. The job is, it is thought, best suited for the sand-slingers. Two sand-slingers (stationary type) are required with a turntable in front of each, the turntables having two stripping plate machines, one for drag and one for the top part. These are all placed near the centre of the shop at one end, the conveyor running alongside, the machines being inside the conveyor circle. A core machine would be placed against the wall opposite the moulding machines. The turntable would be swung round by hand and the boxes placed on the conveyor by hand. The cores would also be placed by hand. The boxes would travel on the conveyor lengthwise and be poured opposite the cupola, which would be placed just outside the shop near the centre longitudinally. Contrary to present continuous casting methods, it is suggested that the cupola should be so arranged, in size and output, that the boxes might be cast direct from the spout. A tilting-well type spout being designed for the purpose having a four-spout pouring device. The shake-out need not be described, as it is in constant use in all continuous-casting practice. The sand would be reconditioned and returned to the machines underground. The flasks would be returned on the conveyor, whilst the core bars would be hung on a special power-operated mono-rail. Special arrangements would be made for the core sand, which would be different from the moulding sand. They could easily be made so that that sand was returned to the core machine.

The pipes would be fettled and cleaned at the end of the shop and conveyed to the dipping plant outside by an H-beam mono-rail.

Mechanical Moulding Only.

Again, the sand-slinger is recommended, but it would be of the tractor type. Only one machine would be required per row, with one turntable containing two stripping-plate machines, as for the first method. This method is suitable for 3½-in. and 4-in. sizes, two in a box, and 5-in. and 6-in. sizes, one in a box. The machines would leave the boxes lying in a row, and casting would not be commenced until the moulding had been completed. The core machine in this case would be placed at the commencing end of the row and be operated by two men, who would make the cores and place them. The casting would be done by the usual four-lip ladle conveyed by a mono-rail running over the centre of the row lengthwise. The emptying would in this case be done by a separate squad at the finish of the day's work. This squad would also cut up and recondition the sand for the following day, withdraw the core bars, stack the arbours in a suitable place near the core machine, and remove the pipes to the fettling shop.

Hand Methods Modernised.

Immediately one tackles the problem of mass manufacture of pipes, one encounters methods for producing 2-in., 2½-in. and 3-in. pipes. Both in America and on the Continent they have made all sizes by the one method. In America, the problem is simplified by the fact that the length of the pipe is only 5 ft., although on the Continent they adhere to the British size of 6 ft.

None of the small sizes of pipes, however, is suitable for rapid production in any of the above methods, and, although it has not been, so far as the author is aware, tackled from the basis of present methods of hand moulding, and instead of each moulder doing the whole job of moulding, core making, casting and emptying, each man could be allocated a separate job, sand being supplied from overhead both for cores and moulding, and the boxes conveyed to a point for casting, emptying and returning, much in the same way as method No. 1 described.

Personal opinion is that, done in this way, the outlay of capital would be much reduced and result in much better quality than the attempts which are at present being made by machine moulding. A stripping-plate machine might, however, be introduced with great advantage.

To sum up the whole matter, the road lies straight ahead. All the rough country has been overcome, and success is now appearing above the horizon. Will this area take the lead? If the shorter length of pipe could be adopted in this country, success would be more quickly attained.

* The second instalment of a series of Papers on "The Present Position and Future Prospects of the Light Castings Trade in Falkirk." It was read before the Falkirk Section of the Institute of British Foundrymen, Mr. J. M. Primrose presiding.

DISCUSSION.

Introducing the lecturer the Chairman (Mr. John Primrose) said that members would recall the decision to devote the session to a series of Papers dealing with the making of pipes and light castings by present methods, and the consideration of methods which might be adopted in the future for the increasing and cheapening production. The Paper which Mr. Phillips was to present was the second of the series, and would deal with several methods of producing pipes. In the last Paper he himself had dealt with the production of light castings generally and made a number of suggestions for improving output and reducing costs.

The Chairman then gave a short history of the manufacture of pipes through the ages.

In the course of a somewhat lengthy discussion, practically every possible method of pipe production was mentioned and many opinions were expressed as to the possibilities of resuscitating the pipe industry in Falkirk and of meeting competition. In the main the views of the lecturer were given general approval.

The third Paper of the series of five will deal particularly with the manufacture of rain-water and soil-pipe connections, describing schemes to facilitate production.

The Chairman, in proposing a vote of thanks to the author, said that the fact that the Paper had led to so much discussion showed that the consideration of methods of improving the light-castings industry in the district had aroused the interest of the foundrymen, and that Falkirk was alive to the necessity of changing methods if competition from abroad was to be successfully met.

Book Review.

The Strength at High Temperatures of a Cast and a Forged Steel as used for Turbine Construction, by H. J. Tapsell and A. E. Johnson. Published by H.M. Stationery Office, Adastral House, Kingsway, W.C.2. Price 9d. net. Postage extra.

The work described in the report was carried out at the National Physical Laboratory at the request of the British Electrical and Allied Industries Research Association as part of the programme of the Committee appointed by the Department of Scientific and Industrial Research to direct researches on the behaviour of materials at high temperatures.

In view of the natural desire of steam-power engineers to retain carbon steels for use in their turbine plant at working temperatures above 400 deg. C., the mechanical properties at high temperatures of two steels representative of those used in the construction of steam turbines have been determined. One of the steels chosen was a 0.30 per cent. carbon cast steel such as is used for steam chests, and the other a 0.39 per cent. forged steel suitable for turbine-wheel construction.

The report gives the results of short-time tensile and creep tests of the two steels over a temperature range of, approximately, 400 to 650 deg. C., and provides information of the stress-temperature relations for rates of creep down to 10^{-8} in. per inch per day.

Launch of Submarine "Thames."—H.M. Submarine "Thames," which was ordered from Vickers-Armstrongs on September 1, 1930, has been successfully launched at the Naval Construction Works, Barrow-in-Furness. Very few details of the ship are available for publication, but it may be taken for granted that this important addition to His Majesty's Navy embodies all the latest improvements in submarine design and construction evolved by the best technical brains of the Admiralty and of a firm recognised throughout the world as one of the leading submarine builders.

Coal-Dust Experiments.

MR. HARRY WINTERTON, a Past-President of the Scottish Section of the Institute of British Foundrymen, repeated his interesting lecture on "Mould Facings" to the Wales and Monmouth Branch, on January 23, at a meeting held in the Merchant Venturers College, Bristol. The discussion was particularly interesting as one of its members, MR. BEN HIRD had also carried out a series of tests on similar lines. He opened the discussion and complimented Mr. Winterton upon the amount of trouble he had taken in trying to solve some of the foundrymen's worries. He felt that Mr. Winterton had perfected his own elementary attempts on the same subject. In his own experiments, he had not exceeded 15 per cent. of coal dust and had found that the coarse type could be used with satisfaction when making heavy castings without causing mapping, but his final conclusion was that fine coal dust gave the best results and could be used for both heavy and light castings. He could not agree that mapping was the direct cause of coal dust, but was the result of the coal dust coking and by this coking action an expansion took place which eventually caused cracking and the molten metal found its way into the cracks, thus showing a mapping effect in the casting.

MR. WINTERTON said that he felt that experiments of this kind were well worth while. He also knew that coarse coal dust could be used satisfactorily on the heavier type of castings, but as users found the coarse coal dust to be cheaper than fine, they tried to use it in too many cases and depended upon the blacking or other material to give the desired results.

Referring to a couple of sample castings exhibited, Mr. Winterton said that one had been made with fine coal dust, whilst the other had been made with coarse coal dust and it would be apparent to the most casual observer which of the two was the more satisfactory. There was no doubt that for light castings, fine coal dust exhibited superior characteristics. The speed of pouring and the temperature of the metals also played a very important part. Sometimes a kind of sweating action took place and caused small globules for which the coal dust was often blamed. He had also found that quick pouring with very hot metal often caused cracking in the sand.

MR. J. HIRD asked how scabbing occurred. Was it through lack of coal dust or dampness?

MR. BEN HIRD said that in his experiments he had tried some castings 5 in. by 8 in. by 2½ in. with red sand only. This was done to make sure the sand was entirely free from coal dust, and, although the sand was new, the castings scabbed very badly. When he used the same type of sand with coal dust, scabbing did not occur. He also considered coal dust gave a bond to the grains of the sand, thus giving greater resisting capacity to heat and strain. When scabbing had occurred with the use of coal dust, it only did so when using a common rough type of coal, low in volatile content.

MR. WAYMAN said that the lecturer had referred to the use of Wolverhampton sand. In Bristol it was usual to use Devizes sand. Was there any difference between the two worth consideration? Would it make any difference to the type of coal dust used?

In reply, MR. WINTERTON said that he had referred to Wolverhampton sand because it was the sand in use in the district where the experiments were carried out. It was also considered a good-quality sand. Different parts of the country used different types of sand because of freight costs, but he was not insisting on the use of Wolverhampton sand.

A vote of thanks to Mr. Winterton was proposed by MR. C. E. WILLIAMS, seconded by MR. B. HIRD, and, in reply, MR. WINTERTON said that if they had enjoyed the lecture he had been more than repaid.

A.F.A. Award.

DR. HORACE W. GILLETT, who has been selected for the W. H. MacFadden Medal, which will be awarded at the 1932 Convention of the American Foundrymen's Association, is director of the Battelle Memorial Institute, Columbus, Ohio. He has been especially prominent in research work connected with various branches of metallurgy, much of which pertained to the various cast alloys.

He is an A.B. in chemistry from Cornell University in 1906, and in 1910 was granted the degree of Ph.D. for his work in physical and electrochemistry. His varied experience in the industrial and research world began in 1906, when he served as chemist with Thomas A. Edison, Inc. In 1907-08 he was connected with A. D. Little, Inc., in a similar capacity. Following this, he was for two years manager of the research department of the Aluminium Castings Company, Detroit. Because of his excellent work at this time he was appointed alloy chemist, and later chief alloy chemist of the U.S. Bureau of Mines, being in charge of the Ithaca field office until 1924, during which time he was working on brass melting, developing the rocking electric furnace, on electric smelting, molybdenum and other alloy steels, and endurance of metals.

DR. H. W. GILLETT.

In 1924 Dr. Gillett was appointed chief of the division of metallurgy, U.S. Bureau of Standards, supervising the work on physical metallurgy of ferrous and non-ferrous alloys. In 1929, when the Battelle Memorial Institute, a newly-formed endowed research laboratory, was looking for the best direction of its activities, Dr. Gillett was selected to head this work as director, a position which he now holds. This institution specialises in the fields of metallurgy and fuels. Several of the projects being studied are related directly to the foundry industry, such as high-temperature properties of alloy cast irons, foundry refractories, combustion of pulverised fuel, foundry sands, bearing metals, cast steel, cast iron and cast copper-base alloys, etc.

In addition to holding membership in the American Foundrymen's Association, Dr. Gillett is a member of the A.I.M.E., A.S.S.T., A.S.T.M., American Chemical Society, American Electrochemical Society, the Institute of Metals, and the Iron and Steel Institute. He has been a contributor to many technical publications, and has written a book on molybdenum, cerium and related alloy steels, as well as contributing chapters on colloid behaviour to the books on chemistry in industry and non-ferrous metallurgy.

As Cores containing rosin are on the soft, weak side, they should be used for castings where ready collapsibility is desired to prevent the cracking of the casting.

Institute of British Foundrymen.

(*Concluded from page* 86.)

lads in the classes who after one session's teaching could answer at least 75 per cent. of the questions correctly, whereas the answers this particular youth thought he could give to two out of 14 questions were both hopelessly wrong.

The classes were of inestimable value, especially to the young men in small foundries. It was only in the larger foundries where any kind of systematic training could be undertaken by the firm, but in any foundry the young man could gain a great deal of knowledge, by way of the classes, which, otherwise, he could get only perhaps after many long years of experience in his daily foundry work. In any foundry, of course, the experienced men could, if they wished, do a good deal to help and advise the youth as to why they were doing a job in a particular way.

Entertainment during the evening was provided by Mr. A. MacGauvran (tenor), Mr. G. H. Brearley (baritone) and Mr. N. Fuller (humorist), with Mr. H. Bedford at the piano.

Heat-Resisting Cast Iron.

(*Concluded from page* 88.)

quently gives a metal superior for applications where, for economic reasons, cast iron must be used.

The use of higher nickel additions gives irons in the austenitic condition which possess heat-resisting properties much superior to those of ordinary cast iron, though they are still far inferior to those shown by the heat-resisting nickel-chromium alloys or the heat-resisting steels. Special cast irons thus fill gaps in the series of heat-resisting alloys available to meet the general requirements of the engineer.

The Magnetic Moulder.

(*Concluded from page* 89.)

finished mould is to be removed, squeeze head M is swung by lateral movement around the supporting column N and thereby placed to the rear of the machine. The pivot of this motion is on a ball thrust bearing for easy operation, and during the actual squeeze the head is supported by an outer strain rod O.

At the bottom of this rod is a fixed collar which engages beneath a projecting jaw, cast integral with the magnet pot and base of machine. It will be noted that in order to accommodate boxes of different depths, the height of pressure head may be adjusted by means of screw P actuated by hand wheel R.

Magnetic machines are adaptable for use either on plain squeeze, squeeze strip, downsand frame squeeze and downsand-frame squeeze stripping plate work. Four machines operating on downsand squeeze stripping plate method (British Insulated Patent 349173) have just been supplied, and are incorporated in a continuous plant.

Three machines of various types will be demonstrated at the 1932 British Industries Fair, squeeze strip, downsand-frame squeeze stripping plate and the new rollover squeeze strip. All machines are built by British Insulated Cables, Limited, at Prescot, Lancs, under their patents—321777, 322728, 349173, 325453, 355889—and distribution throughout the British Isles is controlled by Pneulec, Limited, Mafeking Road, Smethwick, near Birmingham.

American Standard Manhole Covers.—American Standards Association, 29, West Thirty-ninth Street, New York, has published a proposal for an American standard for manhole frames and covers. Thirteen types of frames and seven types of covers are recommended to replace the thousands of types now in use. A questionnaire has been sent to producers and users of these articles to determine whether the recommendations of the Association are acceptable

This Week's News in Brief.

Trade Talk.

THE FORTH & CLYDE STEEL WORKS, at Kirkintilloch, which have been closed for some months, are being reopened.

CARRON COMPANY'S charitable fund disbursement for 1931 amounted to £2,025, of which £1,227 went to Falkirk and District Royal Infirmary.

MESSRS. COX & DANKS, LIMITED, have appointed Mr. J. Farrer, of 50, Grosvenor Gardens, Jesmond, Newcastle-upon-Tyne, as their representative on the North-East Coast. Mr. Farrer will deal with the whole of the firm's scrap business in that area.

MESSRS. DENNY BROS., LIMITED, Leven Shipyard, Dumbarton, have launched the t.s.s. "Slieve More," built for the L.M.S. Railway Company. The "Slieve More" is a special-type steamer of high speed, fitted for the carrying of cattle and horses on the Holyhead-Dublin service.

MESSRS. SCOTT & SONS, Bowling, have launched the twin-screw steamer "Rowan," built to the order of the Frontier Town Steamship Company, Limited, of Newry, Co. Down. The vessel is of 550 tons, and will be fitted with triple-expansion machinery by Messrs. Aitchison, Blair, Limited, Clydebank.

THE LONDON OFFICE of the Furness group of companies, comprising the Cargo Fleet Iron Company, Limited, the South Durham Steel & Iron Company, Limited, and Messrs. Cochrane & Company, Limited, are now at 21, Tothill Street, Westminster, S.W.1. The telephone number and telegraphic address are unchanged.

AT AN EXTRAORDINARY GENERAL MEETING of Messrs. G. W. Pearce & Sons (Brassfounders), Limited, held in London, a resolution was passed "that the company be wound up voluntarily," and that Messrs. H. C. Lewis, 63, Temple Row, and H. J. Thornton, 106, Edmund Street, Birmingham, be appointed liquidators.

HURST, NELSON & COMPANY, LIMITED, Flemington, Motherwell, have just received instructions to increase their order for double bogey steel wagons for the Chinese Government. The order was originally for 60 wagons, and is now increased to 100, and has materialised as a result of the indemnities payable by the Chinese Government to this country on account of the Boxer Rising thirty years ago.

THE WHESSOE FOUNDRY & ENGINEERING COMPANY, LIMITED, inform us that they have made an arrangement with the Zschockewerke Aktiengesellschaft, of Kaiserslautern, Germany, for the manufacture of the Zschocke disintegrator plants for the cleaning of blast-furnace gas and of other fuel gases. The rights of manufacture held by the Whessoe Foundry & Engineering Company are for Great Britain and the British Empire.

MR. HARRY BREARLEY, whose name is associated with the discovery of stainless steel, has presented to the Cutlers' Company, Sheffield, the first table-knife blade made in stainless steel, together with other interesting early manufactures. With these he has given a history of the discovery of stainless steel and of its early uses, this history being contained in a sealed envelope not to be opened until the Cutlers' Feast to be held in 1960.

MESSRS. DUNCAN STEWART & COMPANY, LIMITED, London Road Iron Works, Bridgeton, Glasgow, have just completed a contract for 11 steam hydraulic forging presses for the Soviet authorities. The contract was obtained in the face of strong Continental and American competition, and has been carried out with Scottish materials. The presses are designed for the forging of heavy propellor shafts, engine cranks, boiler drums and the like.

SIR JOHN EAGLESOME introduced a discussion on "The Future of Canals" at an informal meeting of the Institution of Civil Engineers on Wednesday, January 20. He pointed out that the configuration of England was such that the estuaries and navigable rivers provided access to a great part of the country, and with the addition of a comparatively small amount of canalisation and improvement, could practically bring the sea to almost all the important manufacturing and productive centres of the country. A salient requirement for efficient canal transport was industrialisation along the course of the canal so as to provide intermediate traffic. Canals could not exist purely on through traffic

MESSRS. STEWARTS & LLOYDS, LIMITED, have informed their shareholders in a circular that the company's offer to the Scottish Tube Company, Limited, has been accepted by the holders of 97 per cent. in value of that company's shares. Extraordinary meetings will be held on February 8 in Glasgow to approve the resolutions necessary for the carrying through of the arrangements with the Scottish Tube Company. It is proposed to increase the capital to £7,370,275 by the creation of 300,000 5 per cent. cumulative third preference shares of £1 and 269,650 additional deferred shares of £1. At the same time the directors are putting forward resolutions to divide the 6 per cent. cumulative preference shares of £10 each and the 10 per cent. preferred ordinary shares of £10 each into shares of £1 each. Apart from other considerations, they are advised that this will make the shares more marketable. The shares are also being renamed.

THE BRITISH THOMSON-HOUSTON COMPANY, LIMITED, Rugby, in the course of a review of developments during 1931, point out, with regard to steam turbines and turbo-alternators, that a 10,000-kw., 3,600-r.p.m. turbo-alternator has been made for the Debray Power Station of the Detroit Edison Company, the turbine being designed for initial steam conditions of 365 lbs. per sq. in. gauge and a total temperature of 1,000 deg. Fah. In addition, the two 67,200-kw. turbo-alternator sets for the Battersea Power Station of the London Power Company are in process of erection. One of the turbines is being supplied by the British Thomson-Houston Company, and the other by the Metropolitan-Vickers Electrical Company. In each case the turbine is of the three-cylinder type designed to operate with steam at 570 lbs. per sq. in. gauge and 850 deg. Fah. total temperature. A B.T.H. 50,000-kw. maximum rated turbo-alternator for the Ironbridge Power Station of the West Midlands Joint Electricity Authority is in course of erection, and should be in operation in a few months. Another notable order for turbine plant is that for the two 75,000-kw. turbo-alternators now under construction for the new Barking extension of the County of London Electric Supply Company. Further, the construction of a 30,000-kw. three-cylinder turbo-alternator for the Ford Motor Company, Dagenham, will be completed shortly in the Rugby works, the turbine being designed for use with steam at 1,200 lbs. per sq. in. superheated to a total temperature of 725 deg. Fah. The B.T.H. Company also has on order two 20,000-kw. two-cylinder steam turbo-alternators for the Greenwich Power Station of the London County Council. During the year two 20,000-kw. 25-cycle turbo-alternator sets have been put into operation in the Ultimo Power Station of the New South Wales Government Railways. A large 3,000-r.p.m. turbo-alternator recently put into service at the Stourport Power Station of the Shropshire, Worcestershire & Staffordshire Electric Power Company is notable in that the alternator is rated at 45,000 k.v.a., 11,000 volts, this being the highest rated machine in this country running at this speed. Ventilation of the alternator is obtained by means of a separate blower-unit, direct driven from the end of the alternator shaft. In connection with rolling-mill plant, a 4,500/11,250-h.p. 375-r.p.m. induction motor, which is being supplied for driving a four-stand continuous rolling-mill, is of interest in that, with the exception of the bearing pedestals, it is of welded construction throughout, the stator, rotor and baseplate being of welded steel. The machine is supplied with a "racking stator," that is to say, it is possible to move the stator axially in order to expose the rotor without disturbing the shaft in its bearings. Also, a 300/600-h.p. 250/500-r.p.m. 450-volt d.c. motor for driving a sizing mill for large tubes will shortly be put into service. This rolling-mill drive is unusual in the respect that it is a reversing drive operating from a constant voltage d.c. supply.

Obituary.

SIR ALFRED YARROW, the marine engineer and shipbuilder, died in London on Sunday, January 24, eleven days after celebrating his 90th birthday.

MR. HORACE WILLIAM JARVIS, of Messrs. Jarvis Bros., Limited, engineers and iron merchants, Middlesbrough, died recently while on a health cruise to the West Indies.

Personal.

MR. S. W. UTLEY, who was President of the American Foundrymen's Association in 1926, has been made chairman of the Board of the Detroit Steel Castings Company, but continues as general manager. Mr. F. A. Melmoth (late of Firths and Lake & Elliot) has been made vice-president in charge of operations.

SIR OLIVER LODGE, F.R.S., has been awarded the Faraday Medal by the Council of the Institution of Electrical Engineers. The Faraday Medal is awarded by the Council of the Institution not more frequently than once a year, either for notable scientific or industrial achievement in electrical engineering or for conspicuous service rendered to the advancement of electrical science, without restriction as regards nationality, country of residence or membership of the Institution. This is the thirteenth award. Sir Oliver Lodge is an honorary member of the Institution of Electrical Engineers.

Contracts Open.

Cardiff, February 9.—Iron and steel stores, for the Town Council. The City Engineer, City Hall, Cardiff.

Clonmel, February 8.—369 tons of cast-iron spigot and socket pipes (3 in. to 6 in.) and specials for the County Tipperary (South Riding) Board of Health. Mr. T. P. Meade, county surveyor, County Buildings, Clonmel.

Leeds, February 16.—Iron and steel stores, for the Electricity Department. Mr. Nelson Hefford, general manager, Electricity Department, 1, Whitehall Road, Leeds.

Liverpool, February 10.—Iron and steel stores, for the Corporation. The City Engineer, Municipal Buildings, Dale Street, Liverpool.

London, N., February 19.—Solid drawn steel tube street lamp columns, 21 ft. 6 in. in length, with cast-iron bases and fittings, for the Islington Borough Council. The Borough Electrical Engineer, 60, Eden Grove, Holloway, London, N.7.

Manchester, February 9.—Iron and steel stores, for the Corporation (Transport Committee). The General Manager, Corporation Transport Department, 55, Piccadilly, Manchester.

Portsmouth, February 16.—Electrically-driven centrifugal pumping plant, for the Town Council. Mr. R. J. Jenkins, city engineer, Guildhall, Portsmouth. (Fee £2 2s., returnable.)

Patent Specifications Accepted.

The following list of Patent Specifications accepted has been taken from the "Illustrated Official Journal (Patents)." Printed copies of the full Specifications are obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1s. each. The last numbers given are those under which the Specifications will be printed and abridged, and all subsequent proceedings will be taken.

31,177. FELTEN & GUILLEAUME CARLSWERK AKT.-GES. Reducing the extension in wire ropes. 358,734.

15,807. KRUPP GRUSONWERK AKT.-GES., F. Rotary shears for cutting metals. 358,870.

14,019. VEREINIGTE STAHLWERKE AKT.-GES. Corrosion-resisting steel and iron. 360,905.

23,444. SOC. D'EXPLOITATION DES PROCEDES MAHOUX. Hardening of steel and its alloys. 360,833.

23,966. SKLENAR, W. F., RONAN, A. H., and BRITISH REVERBERATORY FURNACES, LIMITED. Reverberatory furnaces. 360,855.

23,987. MACDONALD, H., and FULTON, J. Apparatus for feeding or delivering sheets. 360,859.

24,417. STEPHENSON, H. P. Metal framework applicable to openwork steel flooring or reinforcement for concrete. 360,972.

24,523. BAILEY, R. W. Production of metal castings. 360,980.

25,766. GMACH, L. T. Composite sheet material and the production thereof. 361,012.

27,479. FREDRIKSEN, H. M. Metal alloy, and method of making the same. 361,041.

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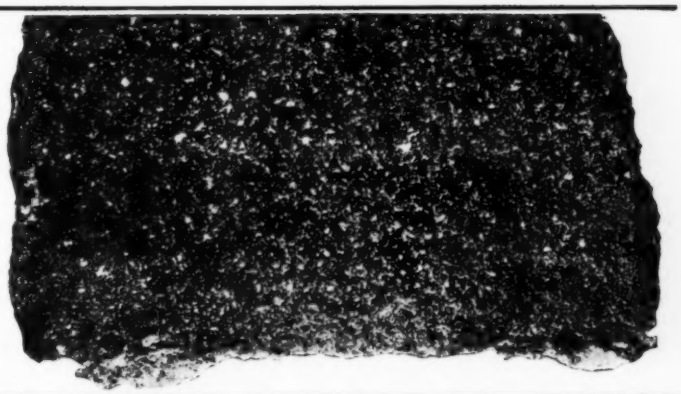

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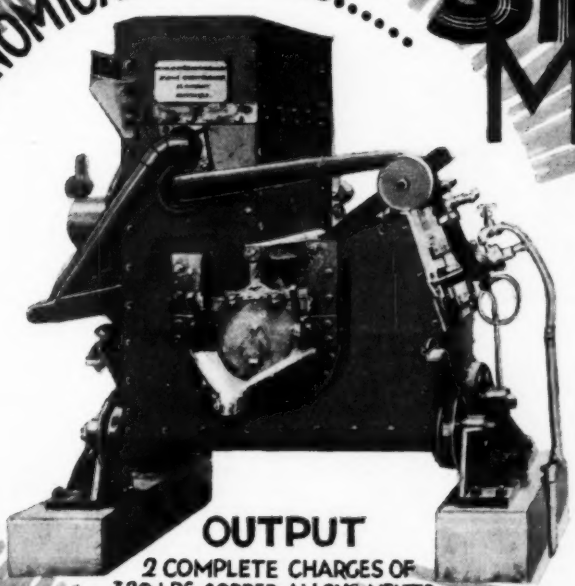

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Raw Material Markets.

Business is quiet in the iron and steel trades. Only small orders to satisfy immediate requirements are being given out. Inquiries from abroad continue to arrive in good volume, but little business has so far resulted. Imports of Continental pig-iron have practically ceased, but Indian iron continues to arrive in Scotland and elsewhere. There are hopes that the demand for finished steel will shortly improve, but trade meanwhile is very dull.

Pig-Iron.

MIDDLESBROUGH.—The inactivity of consumers is shown in the unsatisfactory position of the Cleveland pig-iron market. Purchases are restricted to a minimum, and only the stringent curtailment of output preserves a balance between supply and demand. Only six of the 17 furnaces now operating in this district are on Cleveland iron. Export sales are on a small scale, and less iron is being sent to Scotland, where Midlands iron can now be obtained at about 2s. per ton less. There has been no alteration in prices, which remain as follow:—No. 3 Cleveland G.M.B., 58s. 6d.; No. 1 foundry, 61s.; No. 4 foundry, 57s. 6d.; No. 4 forge iron, 57s. per ton.

In the East Coast hematite market prices have weakened somewhat, and prompt parcels are available at 64s. 6d. per ton, but the general forward quotation is still 65s. There has been some improvement in the inquiry from the Sheffield area. In the North-West of England the hematite trade is suffering from a lack of forward business, the only orders received being for small lots for immediate delivery. Makers' stocks are reported to be increasing, but prices remain unchanged, 66s., at works, being the nominal figure for West Coast mixed numbers.

LANCASHIRE.—The same inactivity is noticeable in this market, and consumers will only buy when urgently necessary. The light-castings foundries, however, are calling for regular deliveries, and consumption as a whole is not far below the level of recent months. The export trade shows no improvement. Prices remain the same, with Midland foundry makes offered for delivery to users in the Manchester price zone at 67s. per ton, North-East Coast at 67s., Northamptonshire at 65s. 6d., Derbyshire forge iron at 62s., Scottish pig-iron at about 87s. and West Coast hematite at 81s.

MIDLANDS.—Sales of pig-iron are mostly confined to small parcels for early delivery, as the majority of consumers are already covered by contracts extending to March and beyond. The general engineering industries in this area remain depressed. For delivery to Birmingham and Black Country stations, makers quote 62s. 6d. for Northants No. 3 and 66s. for Derbyshire, North Staffordshire and Lincolnshire No. 3.

SCOTLAND.—Business is at a low ebb, and no orders of any importance are being placed. There are still only five furnaces operating in Scotland. In some cases, where furnaces have been off for a considerable period, the makers report that stocks of certain grades of iron have become exhausted, but there is no talk of an increase in production. The price of No. 3 Scotch foundry remains at 69s. 6d. at furnaces, with 2s. 6d. extra for No. 1. The quotation for No. 3 Middlesbrough at Grangemouth is not more than 60s., with other English irons quoted at about 2s. per ton less. There is still practically no competition from Continental pig iron, but Indian iron, principally basic, continues to arrive regularly against old sales.

Coke.

The foundry-coke market in the Midlands has fallen away decidedly, but furnace qualities maintain their position, as the output of the latter grade is much restricted. Prices (f.o.t. Birmingham) are as follow: Best Welsh foundry, 32s. to 39s. 6d.; second quality, 29s. to 32s. 6d.; best Durham, 34s. to 37s. 6d.; furnace, 21s. 6d. to 23s. 6d. Prices generally are firmly held, as it is recognised that any improvement in iron and steel would quickly affect the market.

Steel.

Little new business is forthcoming in the finished-steel market. Shipbuilders and constructional engineers have few orders to give out, while exports are negligible in comparison with the volume of inquiries, which had encouraged the rollers to hope for a slight revival. The semi-finished steel works are steadily engaged on a number of small orders to satisfy consumers' immediate needs, but no bulk tonnages are involved. Less material is being bought from the Continental producers.

Scrap.

The Cleveland scrap iron and steel market is showing signs of weakness, consumers in general not being in a position to buy. However, ordinary quality cast-iron scrap is still quoted at 45s. per ton. Good machinery quality in handy sizes is at 47s. 6d. Light metal can be bought at 38s. per ton. In the Midlands market, prices have an easier tendency, though as yet the merchants are mostly unwilling to accept a lower level. Machinery cast iron, broken into handy sizes, is offered at 50s. to 52s. 6d. per ton delivered. Light cast-iron scrap is firm at 40s. per ton delivered. Supplies are plentiful in the Welsh and Scottish markets, and little buying has taken place.

Metals.

Copper.—In spite of the output-curtailment scheme put into operation by the producers, the copper market has shown a decided tendency to weaken, chiefly on selling other than by the Exporters. The latter's c.i.f. quotation remains at 7.625 cents per lb., but on Friday the Customs plants were quoting 0.5 cent per lb. less. Even at these levels, sales remain disappointing, and further reductions may be made. There seems to be no indication of any increase in consumption in the United States, and it is thought that many consumers are already covered well ahead, in some cases until the end of the year. Hence, the outlook is not hopeful, and only a definite revival in the consuming industries can bring about an improvement.

Closing quotations:—

Cash.—Thursday, £38 to £38 1s. 3d.; Friday, £37 5s. to £37 7s. 6d.; Monday, £37 12s. 6d. to £37 13s. 9d.; Tuesday, £38 3s. 9d. to £38 5s.; Wednesday, £37 17s. 6d. to £38.

Three Months.—Thursday, £38 2s. 6d. to £38 3s. 9d.; Friday, £37 7s. 6d. to £37 8s. 9d.; Monday, £37 12s. 6d. to £37 15s.; Tuesday, £38 1s. 3d. to £38 2s. 6d.; Wednesday, £37 10s. to £37 12s. 6d.

Tin.—Consumers here have shown slightly more interest in the tin market, and several large contracts have been reported, in some cases for delivery up to the end of the year. In the United States the market remains steady, with business on the small side. It is thought, however, that consumers' stocks must now be reaching more normal proportions, especially in view of the volume of second-hand selling that has continued for some time. A favourable sign is the reopening of an English tin mine at Pendeen, in Cornwall, which has been made possible since the depreciation of sterling. There are now three mines in operation in Cornwall.

Official closing prices:—

Cash.—Thursday, £138 7s. 6d. to £138 10s.; Friday, £137 15s. to £137 17s. 6d.; Monday, £139 15s. to £139 17s. 6d.; Tuesday, £140 17s. 6d. to £141; Wednesday, £138 12s. 6d. to £138 17s. 6d.

Three Months. — Thursday, £141 5s. to £141 7s. 6d.; Friday, £140 10s. to £140 12s. 6d.; Monday, £142 7s. 6d. to £142 10s.; Tuesday, £143 10s. to £143 12s. 6d.; Wednesday, £141 5s. to £141 7s. 6d.

Spelter.—The spelter market is dull, there being only a limited demand for the goods manufactured by consumers, but there is no pressure to sell. The position on the Continent remains most unsatisfactory, buying being at a low ebb. It is a curious fact that some British consumers are finding it difficult to secure supplies of special brands; due to the curtailment of output by the producers.

Daily fluctuations:—

Ordinary.—Thursday, £14 2s. 6d.; Friday, £13 16s. 3d.; Monday, £14; Tuesday, £14 3s. 9d.; Wednesday, £13 17s. 6d.

Lead.—In the absence of buying, lead has been largely influenced by the movements of the other base metals. Sales last week were only a little over 2,000 tons. Prospects at the moment are not bright, but the lead market would be among the first to reflect any revival in industry.

The week's prices have been:—

Soft Foreign (Prompt).—Thursday, £14 10s.; Friday, £14 7s. 6d.; Monday, £14 10s.; Tuesday, £14 12s. 6d.; Wednesday, £14 7s. 6d.

Iron and Steel Output in December.

The National Federation of Iron and Steel Manufacturers report that there were 70 furnaces in blast at the end of December, the same number as at the end of the previous month, two furnaces having commenced operations and two having gone out of blast. Production of pig-iron in December amounted to 330,600 tons, compared with 296,400 in November and 349,800 tons in December, 1930. The production included 86,500 tons of hematite, 128,200 tons of basic, 96,000 tons of foundry and 15,200 tons of forge iron. The December output of steel ingots and castings amounted to 422,400 tons, compared with 459,200 in November and 337,200 tons in December, 1930.

The December output figures bring the total for the year to 3,758,100 tons of pig-iron, compared with 6,192,400 in 1930, and of steel to 5,175,600 tons, compared with 7,325,700 in 1930.

The following table shows the average monthly production of pig-iron and steel ingots and castings in 1913, 1920, 1928 to 1930, and the production in each month since December, 1930:—

	Pig iron.	Steel ingots and castings.
	Tons.	Tons.
1913 Monthly average ..	855,000	638,600
1920 " ..	669,500	755,600
1928 " ..	550,800	710,100
1929 " ..	632,400	803,000
1930 " ..	516,000	610,500
December	349,800	337,200
1931—		
January	337,200	402,200
February	318,200	486,400
March	357,100	500,100
April	323,200	397,400
May	346,500	435,100
June	323,800	428,900
July	317,000	428,700
August	275,700	357,300
September	248,200	400,500
October	284,200	457,400
November	296,400	459,200
December	330,600	422,400

Annealing Furnace 60-ft. Long.—One of the largest annealing furnaces in the United States has been built by Babcock & Wilcox, Limited, at its Barberton, O., works, the unit to be used for strain-relieving large fusion-welded pressure vessels, such as boiler drums, oil stills, reaction chambers and autoclaves, and for heat treating alloy steel structures. Its 14-ft. 6-in. width inside the lining accommodates the largest diameter that can be delivered, while its 60-ft. length inside the lining accommodates the usual range of vessel lengths, and the longest vessels that can be delivered can be handled by annealing one end at a time. One of the welded jobs recently strain-relieved in this furnace was a one-piece bubble tower 90 ft. long, 12 ft. dia., and weighing over 162 tons. A complete range of smaller diameters has been handled with plate thicknesses varying from $\frac{7}{16}$ in. to 3 in.—"Steel."

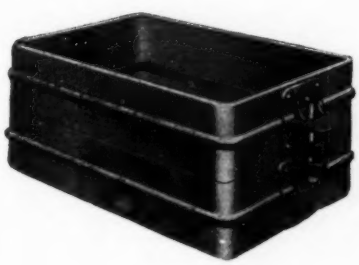
Service Sterling

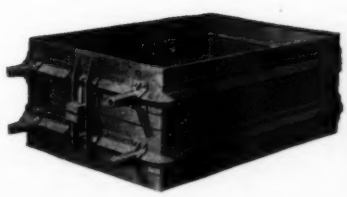
SOLID RIBBED ROLLED STEEL
MOULDING BOXES

This advertisement is an appeal to those foundrymen who for various reasons have not yet used Sterling Boxes and proved their merits.

To such new friends we venture to say:—permit us to help you to enjoy that carefree experience which follows the installation of Sterling Boxes in your foundry. It is our wish to place at your disposal the full resources of our organisation and to help solve for you any problems associated with the employment of moulding boxes.

Many hundreds of foundries in this country and overseas have proved the superiority of the Sterling Box over all other types, and the volume of repeat orders received from these users is genuine testimony that Sterling Boxes are not only the best boxes but are also the cheapest when all facts are considered.





STERLING FOUNDRY SPECIALTIES LIMITED.

London Office:—
13, Victoria Street, S.W.1.

BEDFORD

Agents at:—
MANCHESTER.
GLASGOW.
NEWCASTLE-ON-TYNE.

TELEGRAMS: "STERFLASK, BEDFORD" TELEPHONE: 3345 BEDFORD.
CODE: WESTERN UNION

WEEKLY PRICE CURRENT.

COPPER.

	£	s.	d.
Standard cash	37	17	6
Three months	37	10	0
Electrolytic	43	10	0
Tough	40	0	0
Best selected	40	10	0
Sheets	74	0	0
India	51	0	0
Wire bars	44	10	0
Do., March	44	10	0
Do., April	44	10	0
Ingot bars	44	10	0
H.C. wire rods	46	10	0
Off. av. cash, Jan.	39	10	1¼
Do., 3 mths., Jan.	39	12	9¾
Do., Sttlmnt., Jan.	39	9	7½
Do., Electro, Jan.	47	1	6
Do., B.S., Jan.	41	16	10½
Do., wire bars, Jan.	47	19	0
Solid drawn tubes			11¼d.
Brazed tubes			11¼d.
Wire			7¼d.

BRASS.

Solid drawn tubes	10d.
Brazed tubes	12d.
Rods, drawn	9d.
Rods, extd. or rlld.	5¼d.
Sheets to 10 w.g.	8¼d.
Wire	8¼d.
Rolled metal	8d.
Yellow metal rods	5¼d.
Do. 4 × 4 Squares	6¼d.
Do. 4 × 3 Sheets	6¼d.

TIN.

	£	s.	d.
Standard cash	138	12	6
Three months	141	5	0
English	140	5	0
Bars	142	5	0
Straits	141	15	0
Australian	141	0	0
Eastern	143	5	0
Banca	148	17	6
Off. av. cash, Jan.	140	5	6¾
Do., 3 mths., Jan.	143	6	3
Do., Sttlmt., Jan.	140	5	4½

SPELTER.

	£	s.	d.
Ordinary	13	17	6
Remelted	13	5	0
Hard	11	5	0
Electro 99.9	16	7	6
English	14	17	6
India	13	5	0
Zinc dust	23	0	0
Zinc ashes	3	12	6
Off. aver., Jan.	14	12	6
Aver. spot, Jan.	14	8	3⅜

LEAD.

	£	s.	d.
Soft foreign ppt.	14	7	6
English	16	0	0
Off. average, Jan.	15	2	1½
Average spot, Jan.	15	1	8¼

ZINC SHEETS, &c.

	£	s.	d.
Zinc sheets, English	24	10	0
Do., V.M. ex-whf.	23	10	0
Rods	32	0	0
Boiler plates			—
Battery plates			—

ANTIMONY.

	£	s.	d.
Special brand, Eng.	40	0	0
Chinese (nom.)	28	10	0
Crude	22	0	0

QUICKSILVER.

	£	s.	d.
Quicksilver (nom.)	17	12	6

FERRO-ALLOYS AND STEEL-MAKING METALS.

Ferro-silicon—	
25%	£6 17 6
45/50%	£10 15 0
75%	£16 0 0
Ferro-vanadium—	
35/50%	12/8 lb. Va.
Ferro-molybdenum—	
70/75% c. free, 4/2, plus 55%, per lb. of Mo.	
Ferro-titanium—	
23/25% carbon-free	11¼d. lb.
Ferro-phosphorus, 20/25%	£21 17 6
Ferro-tungsten—	
80/85%	1/8½ lb. plus 20%
Tungsten metal powder—	
98/99%	1/11½ lb. plus 20%
Ferro-chrome—	
2/4% car.	£34 0 0
4/6% car.	£24 10 0
6/8% car.	£23 2 6
8/10% car.	£22 15 0
Ferro-chrome—	
Max. 2% car.	£36 10 0
Max. 1% car.	£41 0 0
Max. 0.70% car.	£50 7 6
70% carbon-free	11d. lb.
Nickel—80/99.5%	£240 to £245
Ferro-cobalt	9/10 lb.
Aluminium 98/99%	£95 0 0
Metallic chromium—	
96/98%	3/- lb.
Ferro-manganese (net)—	
76/80% loose	£10 15 0 to £11 5 0
76/80% packed	£11 15 0 to £12 5 0
76/80% export	(nom.) £ 9 0 0
Metallic manganese—	
94/96% carbon-free	1/6 lb.

Per ton unless otherwise stated.

HIGH-SPEED TOOL STEEL.

Finished bars, 14% tungsten	2s. 0d.
Finished bars, 18% tungsten	2s. 9d.

Per lb. net, d/d buyers' works.

Extras—	
Rounds and squares, 3 in. and over	4d. lb.
Rounds and squares, under ½ in. to ¼ in.	3d. lb.
Do., under ¼ in. to 7/16 in.	1/- lb.
Flats, ½ in. × ¼ in. to under 1 in. × ⅛ in.	3d. lb.
Do., under ½ in. × ¼ in.	1/- lb.
Bevels of approved sizes and sections	6d. lb.

Bars cut to length, 10% extra.

SCRAP.

	£	s.	d.		£	s.	d.
South Wales—							
Heavy steel	2	5	0	to	2	5	6
Bundled steel and shrngs.	1	17	0	to	1	18	0
Mixed iron and steel	2	1	0	to	2	2	0
Heavy cast iron					2	7	0
Good machinery for foundries					2	12	6
Cleveland—							
Heavy steel					2	0	0
Steel turnings					1	12	6
Cast-iron borings					1	6	0
Heavy forge					2	17	6
W.I. piling scrap					2	10	0
Cast-iron scrap	2	5	0	to	2	7	6
Midlands—							
Light cast-iron scrap					2	0	0
Heavy wrought iron					2	12	6
Steel turnings, f.o.r.					1	3	0
Scotland—							
Heavy steel					2	2	6
Ordinary cast iron					2	8	6
Engineers' turnings					1	11	6
Cast-iron borings					1	12	0
Wrought-iron piling					2	5	0
Heavy machinery					2	15	0

London—Merchants' buying prices delivered yard.

	£	s.	d.
Copper (clean)	30	0	0
Brass	22	0	0
Lead (less usual draft)	12	10	0
Tea lead	9	10	0
Zinc	6	10	0
New aluminium cuttings	62	0	0
Braziery copper	27	0	0
Gunmetal	26	0	0
Hollow pewter	90	0	0
Shaped black pewter	70	0	0

PIG-IRON.

(f.o.t. unless otherwise stated.)

N.E. Coast—	
Foundry No. 1	61/-
Foundry No. 3	58/6
Foundry No. 4	57/6
Forge No. 4	57/-
Hematite No. 1	65/-
Hematite M/Nos.	64/6
N.W. Coast—	
Hem. M/Nos. d/d Glas.	73/-
„ d/d Birm.	84/6
Malleable iron d/d Birm.	117/6
Midlands—	
Staffs common*	—
„ No. 4 forge*	61/-
„ No. 3 fdry.*	66/-
Shrops basic	—
„ Cold blast, ord.	—
„ „ roll iron	—
Northants forge*	57/6
„ fdry. No. 3*	62/6
„ fdry. No. 1*	65/6
Derbyshire forge*	61/-
„ fdry. No. 3*	66/-
„ fdry. No. 1*	69/-
„ basic*	—

*d/d Black Country dist.

Scotland—	
Foundry No. 1	72/-
„ No. 3	69/6
Hem. M/Nos. d/d	68/6
Sheffield (d/d district)—	
Derby forge	58/6
„ fdry. No. 3	63/6
Lincs forge	—
„ fdry. No. 3	63/6
E.C. hematite	74/6
W.C. hematite	83/6
Lancashire (d/d eq. Man.)—	
Derby forge	62/-
„ fdry. No. 3	67/-
Staffs fdry. No. 3	67/-
Northants fdry. No. 3	65/6
Cleveland fdry. No. 3	67/-
Dalzell, No. 3 (special)	102/6 to 105/-
Glengarnock, No. 3	87/-
Clyde, No. 3	87/-
Monkland, No. 3	87/-
Summerlee, No. 3	87/-
Eglinton, No. 3	87/-
Gartsherrie, No. 3	87/-
Shotts, No. 3	87/-

FINISHED IRON AND STEEL.

Usual District deliveries for iron; delivered consumers' station for steel.

Iron—	£	s.	d.		£	s.	d.
Bars (cr.)	9	15	0	to	10	0	0
Nut and bolt iron	8	7	6	to	8	10	0
Hoops	10	10	0	to	12	0	0
Marked bars (Staffs) f.o.t.					12	0	0
Gas strip	10	10	0	to	12	0	0
Bolts and nuts, ¾ in. × 4 in.					12	5	0
Steel—							
Plates, ship, etc.	8	15	0	to	8	17	6
Boiler plts.	8	15	0	to	9	15	0
Chequer plts.					10	7	6
Angles					8	7	6
Tees					9	7	6
Joists					8	15	0
Rounds and squares, 3 in. to 5½ in.					9	7	6
Rounds under 3 in. to ¾ in. (Untested)			6	15	0	& up.	
Flats—8 in. wide and over					8	12	6
„ under 8 in. and over 5 in.					8	17	6
Rails, heavy	8	5	0	to	8	10	0
Fishplates					12	0	0
Hoops (Staffs)					9	10	0
Black sheets, 24g.	8	0	0	to	9	0	0
Galv. cor. shts.	9	0	0	to	9	5	0
Galv. flat sheets	9	10	0	to	9	15	0
Galv. fencing wire, 8g. plain					12	10	0
Billets, soft	5	7	6	to	5	12	6
Billets, hard					6	12	6
Sheet bars	5	0	0	to	5	5	0
Tin bars					5	0	0

PHOSPHOR BRONZE.

	Per lb. basis.
Strip	11⅜d.
Sheet to 10 w.g.	12⅜d.
Wire	13⅜d.
Rods	11⅜d.
Tubes	17d.
Castings	13d.

Delivery 3 cwt. free.
10% phos. cop. £30 above B.S.
15% phos. cop. £35 above B.S.
Phosphor tin (5%) £30 above price of English ingots.
C. Clifford & Son, Limited.

NICKEL SILVER, &c.

	Per lb.
Ingots for raising	7d. to 1/1
Rolled—	
To 9 in. wide	1/1 to 1/7
To 12 in. wide	1/1¼ to 1/7¼
To 15 in. wide	1/1½ to 1/7½
To 18 in. wide	1/2 to 1/8
To 21 in. wide	1/2½ to 1/8½
To 25 in. wide	1/3 to 1/9
Ingots for spoons and forks	7d. to 1/3½
Ingots rolled to spoon size	10d. to 1/6½
Wire round—	
to 10g.	1/4½ to 1/11½

with extras according to gauge.
Special 5ths quality turning rods in straight lengths, 1/3½ upwards.

AMERICAN IRON AND STEEL.

At Pittsburgh unless otherwise stated.

	Dols.
No. 2 foundry, Phila.	15.64
No. 2 foundry, Valley	15.50
No. 2 foundry, Birm.	11.00
Basic	16.89
Bessemer	17.89
Malleable	17.89
Grey forge	17.44
Ferro-mang. 80%	75.00
O.-h. rails, h'y, at mill	43.00
Billets	28.00
Sheet bars	27.00
Wire rods	37.00
	Cents.
Iron bars, Phila.	2.11
Steel bars	1.50
Tank plates	1.50
Beams, etc.	1.50
Skelp, grooved steel	1.50
Skelp, sheared steel	1.50
Steel hoops	1.65
Sheets, black, No. 24	2.15
Sheets, galv., No. 24	2.80
Wire nails	1.95
Plain wire	2.20
Barbed wire, galv.	2.60
Tinplates, 100-lb. box	$4.75

COKE (at ovens).

Welsh foundry	22/6 to 25/-
„ furnace	17/6
Durham and Northumberland—	
„ foundry	14/6 to 15/-
„ furnace	14/6
Midlands, foundry	—
„ furnace	—

TINPLATES.

f.o.b. Bristol Channel ports.

I.C. cokes	20×14 per box	14/- to 14/9
„	28×20 „	28/- to 29/6
„	20×10 „	—
„	18½×14 „	—
C.W.	20×14 „	12/9 to 13/-
„	28×20 „	25/3
„	20×10 „	19/4½
„	18½×14 „	13/9

SWEDISH CHARCOAL IRON & STEEL.

	£	s.	d.		£	s.	d.
Pig-iron	6	0	0	to	7	0	0
Bars, hammered, basis	16	10	0	to	17	0	0
Bars and nail-rods, rolled, basis	15	17	6	to	16	5	0
Blooms	10	0	0	to	12	0	0
Keg steel	32	0	0	to	33	0	0
Faggot steel	18	0	0	to	23	0	0
Bars and rods dead soft, st'l	10	0	0	to	12	0	0

All per English ton, f.o.b. Gothenburg.
[Subject to an exchange basis of Kr. 18.16 to £1.]

TUBES AND FITTINGS.

Current Discounts.

	Tubes.	*Fittings.*
Gas	65%	57½%
Water ..	61½%	52½%
Steam ..	57½%	47½%

DAILY FLUCTUATIONS.

Standard Copper (cash).

			£	s.	d.		
Jan.	28	..	38	0	0	dec.	15/-
,,	29	..	37	5	0	,,	15/-
Feb.	1	..	37	12	6	inc.	7/6
,,	2	..	38	3	9	,,	11/3
,,	3	..	37	17	6	dec.	6/3

Electrolytic Copper.

			£	s.	d.		
Jan.	28	..	45	0	0	No change	
,,	29	..	44	10	0	dec.	10/-
Feb.	1	..	45	0	0	inc.	10/-
,,	2	..	43	10	0	dec.	30/-
,,	3	..	43	10	0	No change	

Standard Tin (cash).

			£	s.	d.		
Jan.	28	..	138	7	6	dec.	27/6
,,	29	..	137	15	0	,,	12/6
Feb.	1	..	139	15	0	inc.	40/-
,,	2	..	140	17	6	,,	22/6
,,	3	..	138	12	6	dec.	50/-

Tin (English ingots).

			£	s.	d.		
Jan.	28	..	140	0	0	dec.	25/-
,,	29	..	139	0	0	,,	20/-
Feb.	1	..	141	0	0	inc.	40/-
,,	2	..	142	5	0	,,	25/-
,,	3	..	140	5	0	dec.	40/-

Zinc Sheets (English).

			£	s.	d.		
Jan.	28	..	24	10	0	No change	
,,	29	..	24	10	0	,,	,,
Feb.	1	..	24	10	0	,,	,,
,,	2	..	24	10	0	,,	,,
,,	3	..	24	10	0	,,	,,

Spelter (ordinary).

			£	s.	d.		
Jan.	28	..	14	2	6	dec.	3/9
,,	29	..	13	16	3	,,	6/3
Feb.	1	..	14	0	0	inc.	3/9
,,	2	..	14	3	9	,,	3/9
,,	3	..	13	17	6	dec.	6/3

Lead (English).

			£	s.	d.		
Jan.	28	..	16	0	0	dec.	5/-
,,	29	..	16	0	0	No change	
Feb.	1	..	16	0	0	,,	,,
,,	2	..	16	0	0	,,	,,
,,	3	..	16	0	0	,,	,,

AVERAGE PRICES OF GALVANISED CORRUGATED SHEETS (NORTH OF ENGLAND).

Year.	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Yearly average.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1901	13 0 0	12 5 0	11 10 0	11 16 0	11 10 0	11 10 0	11 10 0	11 10 0	12 0 0	12 0 0	12 0 0	12 0 0	11 17 1
1902	12 0 0	11 10 0	11 10 0	11 10 0	11 15 0	11 15 0	11 15 0	11 15 0	11 15 0	11 15 0	11 15 0	11 15 0	11 14 2
1903	11 5 0	11 5 0	11 5 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 5 0	11 5 0	11 5 0	11 5 0	11 7 1
1904	11 5 0	11 5 0	11 5 0	11 5 0	10 15 0	10 15 0	10 15 0	10 15 0	10 5 0	10 5 0	10 5 0	10 5 0	10 15 0
1905	10 7 6	10 7 6	10 7 6	10 7 6	10 7 6	10 7 6	10 7 6	10 7 6	11 0 0	11 5 0	11 15 0	12 0 0	10 15 0
1906	12 12 6	12 12 6	12 12 6	12 7 6	12 7 6	12 7 6	12 12 6	12 12 6	12 15 0	12 15 0	12 15 0	13 5 0	12 18 11½
1907	13 5 0	13 5 0	13 15 0	13 15 0	13 15 0	13 15 0	13 17 6	13 17 6	13 17 6	13 2 6	13 2 6	13 2 6	13 10 10
1908	13 2 6	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 11 0½
1909	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	10 10 0	11 0 0	11 0 0	11 0 0	11 0 0	11 16 8
1910	11 15 0	12 5 0	12 5 0	11 15 0	11 10 0	11 10 0	11 12 6	11 12 6	11 12 6	11 12 6	11 10 0	11 10 0	11 13 4
1911	11 5 0	11 1 3	10 15 0	10 15 0	10 13 9	10 10 0	10 13 9	11 0 0	11 5 0	11 5 0	11 5 0	11 7 0	10 19 7½
1912	11 10 0	11 10 0	11 10 0	11 15 0	12 5 0	12 5 0	12 5 0	12 5 0	12 5 0	12 12 6	12 18 0	12 15 0	12 2 11½
1913	12 15 0	12 15 0	12 15 0	12 11 3	11 18 0	11 15 0	11 15 0	11 15 0	11 15 0	11 3 0	11 0 0	11 2 6	11 18 4
1914	11 7 0	11 7 6	11 7 6	11 5 7½	11 2 6	10 15 0	10 15 0	12 17 6	14 2 0	13 7 0	11 15 7	11 2 6	11 16 0
1915	11 10 8½	13 12 6	14 8 9	15 0 6	17 17 6	20 17 6	20 17 6	20 6 3	17 12 6	18 1 0	22 13 9	25 2 0	18 3 4½
1916	26 5 0	27 12 6	28 0 0	28 5 0	29 0 0	29 0 0	28 15 0	28 3 0	28 15 0	28 15 0	28 15 0	28 15 0	28 6 8½
1917	28 15 0	28 15 0	28 15 0	28 15 0	28 15 0	28 15 0	28 15 0	28 15 0	28 15 0	28 0 0	28 0 0	28 0 0	28 11 3
1918	28 5 0	28 15 0	29 0 0	29 0 0	29 0 0	29 0 0	29 0 0	29 0 0	29 0 0	29 0 0	29 0 0	29 0 0	28 13 4
1919	29 0 0	29 0 0	29 0 0	28 0 0	28 10 0	27 7 6	27 5 0	29 3 0	32 0 0	33 0 0	36 10 0	40 8 4	31 5 3½
1920	46 10 0	49 15 0	53 15 0	56 0 0	55 10 0	54 10 0	52 10 0	48 10 0	44 3 4	39 2 6	35 17 6	30 8 0	47 4 3
1921	28 10 0	25 17 6	24 5 0	23 3 4	22 0 0	22 0 0	23 10 0	21 12 6	20 0 0	18 15 0	18 3 9	17 2 0	22 1 7
1922	16 17 6	15 13 9	16 3 0	16 10 0	16 4 4½	15 15 6	15 16 3	16 16 0	16 8 9	16 6 3	17 1 0	17 7 6	16 7 5½
1923	18 3 1½	19 1 11½	19 8 0	19 10 0	19 7 0	19 1 3	18 0 0	18 13 1½	19 0 0	19 3 9	19 2 6	18 19 4½	18 19 2
1924	18 13 6	18 9 4½	18 5 0	17 15 11½	17 3 0	17 19 4½	18 7 6	18 8 1½	18 8 1½	17 19 6	17 11 3	17 10 0	18 0 10½
1925	17 8 6	17 1 6½	16 9 4½	16 12 0	16 9 8½	16 9 4½	16 0 6	16 1 10½	16 5 0	16 7 0	16 12 6	6 15 0	16 11 0½
1926	16 14 4½	16 5 7½	16 0 6	15 11 10½	15 11 3	16 0 0	16 16 0	16 18 9	16 14 0	16 18 9	17 10 0	6 19 0	16 10 0½
1927	16 3 1	15 7 6	15 3 3	15 3 1½	14 14 4½	14 11 6	14 1 10½	14 0 0	13 19 6	13 16 10½	13 13 1½	13 3 9	14 9 10
1928	13 0 0½	13 2 6	13 6 0	13 2 6	13 3 0	13 6 9	13 11 3	13 10 0	13 10 7½	13 12 6	13 11 6	13 10 0	13 8 8½
1929	13 11 0	13 13 1½	13 12 9½	13 10 11½	13 9 3	13 8 9	13 11 6	13 7 6	13 7 6	13 5 6	12 18 9	12 12 9½	13 7 5½
1930	12 5 0	11 15 0	11 19 6	11 18 7	11 18 0	11 17 6	11 17 6	11 17 6	11 16 3	11 12 6	11 8 9	11 5 0	11 15 11½
1931	11 4 0	11 0 0	11 0 0	11 0 0	10 13 9	9 18 9	9 13 0	9 5 3½	8 19 0½	9 16 0	9 8 9	9 4 0½	10 1 10½

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With one exception Peter is an ordinary little fellow. Chubby, likeable, just five-and-a-half, full of life and fun, and on occasions—be it admitted—of naughtiness. Just now Peter's rather important, for this is his first term at school, and he's grappling with the intricacies of "A B C" and "Twice-Two": difficult subjects to all men of five-and-a-half, but even more difficult in Peter's case because—bad luck—he's totally blind. That's his One Exception. Peter learns reading, writing, and 'rithmetic through the medium of "Braille"—dull stuff compared with the coloured picture books of most five-and-a-halfs. However, he's a stout lad is Peter, and he's making great progress.

Would you like to know more about him? How, in spite of his "One Exception," he is being educated and, when older, technically trained and usefully employed. There is a long waiting list of "Peters" throughout the British Isles, for whom training and accommodation must be provided in the immediate future.

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